AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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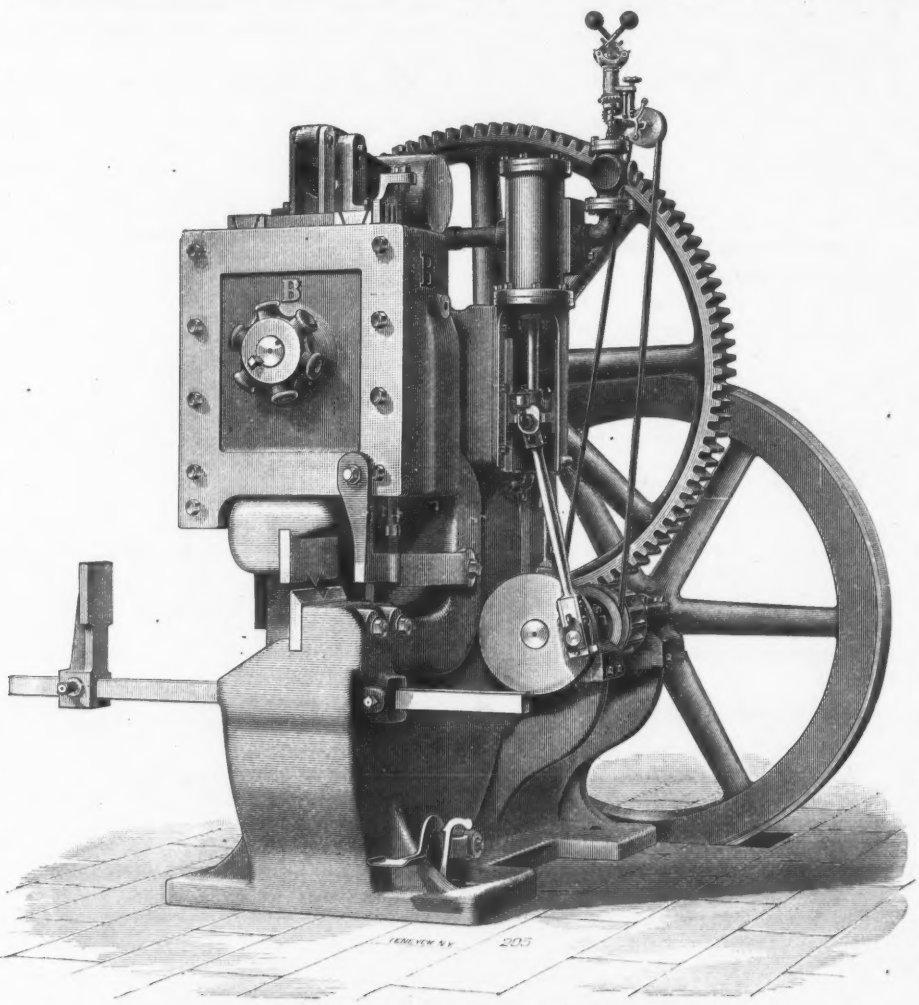
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Steam-driven Cross Cut Shear.

The machine illustrated, which is manufactured by the Long & Allstatter Company, of Hamilton, O., U. S. A., is designed for general cross cut shearing, cutting up bar iron and steel, etc. It has capacity to cut off a round bar two and three quarter inches in diameter, or to shear angles, channels, fish-plates, etc., requiring equal capacity, and in the illustration is shown with shear blades attached for cutting off angle bars. It is provided with a substantial gauge for cutting to length, and, when specially ordered, with an automatic stop, which brings the slide to rest at any point of the stroke desired. The slide is counterbalanced. The machine is driven by a heavy steel cam shaft, and is provided with a hand-wheel in front for turning the shaft by hand when setting and adjusting the tools, etc. The attached steam engine, with governor, makes the machine self-contained and independent of belting and shafting. When desired tight and loose pulleys are furnished for driving by belt.



STEAM-DRIVEN CROSS CUT SHEAR.

Thirty-inch Double Saddle Lathe.

We present herewith an improved form of a machine tool, the prototype of which we have previously illustrated, and which was especially designed for pulleys and work of a similar nature. The present machine, which may be classed with the turret lathes, is designed to do work on cast-iron similar to that done by the larger screw machines on work made from a bar of iron or steel.

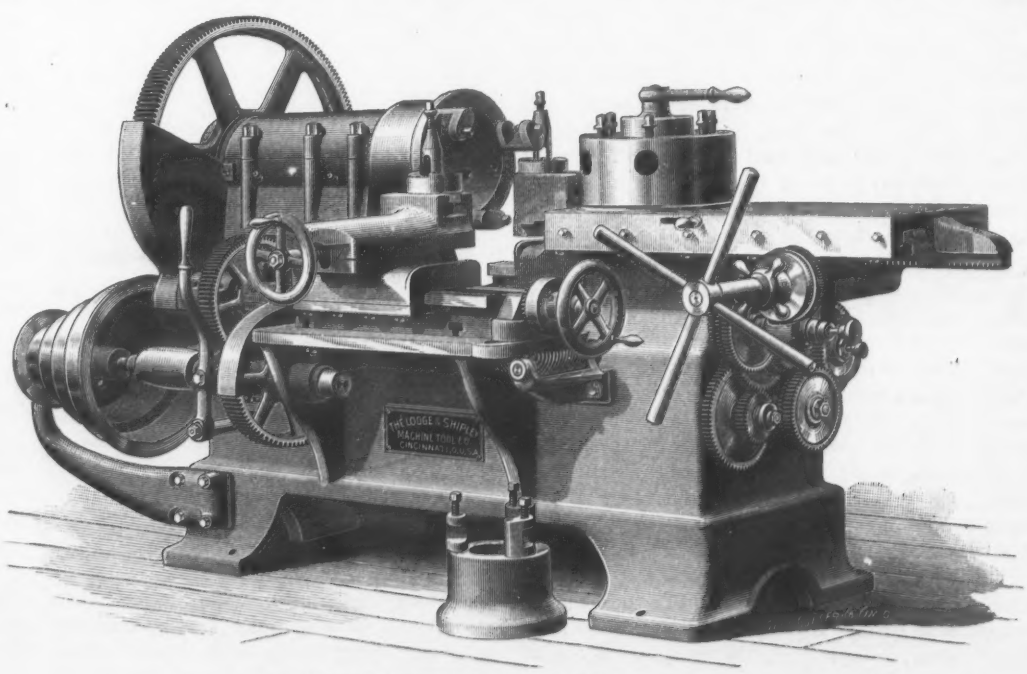
The bed, head-stock, supports for the rails upon which saddles move, foot-stock and legs are all cast in a single piece. The spindle is 6 inches diameter, and has a 3¾-inch hole through its entire length, the outer end being bored taper as usual to receive a center, arbor, or bushing for boring bar. The thread on the end of spindle to receive chuck or face-plate is 9¾ inches diameter.

Motion is given to the spindle by a train of six gears, including the back gears; the gear on the spindle being equal in diameter to the swing of the lathe—30 inches.

The ratio of gearing between pulley shaft and spindle is two to one with back gear out and thirty to one with back gear in; giving a range of speeds from 2 to 180 revolutions per minute. Cone pulley is for a 3½-inch belt.

The saddles are mounted upon rails, one in front and another at the rear the same as in the pulley lathe, feed for these being by means of screws driven by bevel and helical gears with friction device. The rails swivel to any desired angle for producing tapers. Two tools may be used on each saddle if desired.

The feeds for these saddles and for the turret slides as well are derived from the spindle train, the change gears being located at the foot of the lathe bed as shown, where it will be noticed there are push-pins also for quickly varying feeds within certain limits. Either cross-slide may be used on work anywhere within the limits of the swing of the lathe, and the turret slide has a movement of 3 feet 4 inches to and from the live spindle. Turret has six holes.



THIRTY-INCH DOUBLE SADDLE LATHE.

It will be seen that the machine is well adapted for such work as gear blanks, pulleys, couplings, fly-wheels, parts of Corliss and slide-valve engines, etc., requiring to be turned and bored, which operations are simultaneously performed upon this machine if desired.

Power cross-feed may be supplied for either saddle, and also an attached geared crane if desired. The machine as shown weighs about 5,500 pounds. It is built by the Lodge & Shipley Machine Tool Co., Cincinnati, O.

Whether or not there should be a pier in the Hudson River at New York for the proposed bridge we do not attempt to discuss. But one of the best turned arguments against it—if it can be avoided—is made by Gustav H. Schwab. In a letter to *The Evening Post*, after referring to the great advantages of the anchoring and maneuvering ground that would be destroyed by the pier, the danger in fogs, etc., he says:

"If in the place of a pier such as planned nature had placed a rocky island of the same dimensions in the river, does any one conversant with the needs of harbor navigation doubt that the national government would spend millions of dollars to entirely remove this dangerous obstruction?"

Fair Play for the Indicator.

BY FRANK RICHARDS.

SOME CORRECT REDUCING GEARS.

The rapid recent advances in the line of economy in the steam engine were strikingly brought out in the comparison of the "Campania" with the "Great Eastern" in the AMERICAN MACHINIST, September 28th. The engines of the "Great Eastern" of forty years ago, representing the best engineering practice of that time, developed 8,000 horse-power. The engines of the "Campania" to day show 30,000 horse-power on practically the same consumption of coal. In the days of the "Great Eastern" they were citing the engines of that time as proofs of the exhaustive genius of Watt, because so little improvement had been made in the steam engine since his day. And well they might. Watt retired from business in 1800, and the steam engine seems to have undergone comparatively little improvement in the next fifty years. This seems almost unaccountable, for the first half of our century saw the invention, development and wide diffusion of our whole line of machine tools, and the facilities for producing engines multiplied enormously. Steam engines were built in every machine shop in those days. The construction of the engine was, of course, improved, and the sizes of those in common use increased, but little thought was given to economy. The time seems to have been fully occupied in the mere application of steam to the whole range of human industry, and if an engine would only go, and especially if it would go as well as any other engine, everybody was satisfied.

The progress in steam economy in pumping engines is happily summarized by Professor Thurston in his paper on "Maximum Contemporary Economy, etc.," read at the recent meeting of the mechanical engineers. The paper referred to, which might have been entitled "The Best that Steam Can Do To-day in a Pump," says:

"Starting from the 5,000,000 duty of the Savery engines still existing in the time of Watt, the 12,000,000 of Smeaton's Newcomen engine of the same period, and the first figures of Watt, perhaps averaging 20,000,000 foot-pounds per pound of fuel, and tracing the improvement through the most flourishing of Watt's work, when he attained about 30,000,000, and his final perfection of the later Cornish engines, which, still later, attained in ordinary operation 60,000,000 to 80,000,000, we come to the period of successful introduc-

tion of the modern forms of the high-pressure, multiple-expansion pumping engine, from 1860, giving duties ranging up to about 100,000,000 to 110,000,000, and to 120,000,000 in the succeeding generation and to date."

We may say that the chief promoter and adviser all along the way through these later stages of rapid improvement has been the steam engine indicator. The indicator in use before the war was the "Monometer" of the Novelty Iron Works. It had, of course, none of the refinements of the modern instruments. The indicator piston carried the pencil without the multiplying lever to increase its travel. It could not be used for high-speed engines nor for a great range of pressures, and was neither very handy nor very reliable. The Richards indicator was patented in 1863, and with its introduction there began a new era in the study of the steam engine, and a new and rapid advance in general steam economy. Two or three inventors, who have had the luck to invent later, have improved upon the details of the Richards instrument, and to-day the indicator is so perfect that there is no demand for a better one until the better one appears.

The indicator is to-day the companion and the trusted monitor of the steam engine designer and builder as well as of the intelligent and conscientious engineer. The indicator has been in a way quite well appreciated by those who have been so greatly benefited by its services. Its extensive use is its best appreciation. But while it has met with a somewhat commensurate appreciation we can hardly say that it has had as fair treatment all around as it deserves. Isn't it rather late in the day, for instance, for such an investigation of the piping of the indicator as Mr. Willis gives us in the AMERICAN MACHINIST, November 23d? And yet Mr. Willis seems to be the first who has undertaken it, and it needs no saying that, although late, it is of value to everyone who has to do with the indicator.

Much has been said all along about the reducing gear for operating the indicator drum, and the paper by "M. E." in the AMERICAN MACHINIST of the same date as that containing the paper by Mr. Willis, is a very proper contribution to that literature, but it is to be supposed that much more will yet have to be written in the same line. The indifference of the profession upon this important point is sufficiently evidenced by the prevalence of reprehensible practice. It is probable that not one-quarter of the indicator cards being taken at this writing absolutely represent the engine piston movement. If any one thinks this a strong statement, I will be glad to see proofs to the contrary.

Any one familiar with this reducing gear literature must have noticed that it consists largely of fault-finding. Now I am an advocate and defender of fault-finding, and I would be proud if I could think that I was also an expert at it. I believe that fault-finding has begotten a larger progeny of mechanical inventions than necessity has ever nursed. But fault-finding has no justification except in its suggestion of improvement. There must first exist the fault before it can be found and pointed out, and it must be a curable one, or it is not a fault. Aimless "fault-finding" is only nagging, and it is to the honor of human nature that such fault-finding always rouses anger and disgust. Possibly it has worked that way with regard to reducing gear. I don't believe that the users of the indicator are so ignorant of mechanical principles as their indicator practice would seem to indicate. It is rather an evidence of indifference upon the subject than of anything worse, if, indeed, there be anything worse.

Anyhow, in the interest of reformation, suppose that we try a little different way, and to balance the incessant fault-finding let us do a little toward lighting up the correct path and enticing travel toward it. Here are a few reducing gears that give an absolutely correct movement, and, of course, there are a plenty more of them. These are all of the common-sense order, and require no mathematical investigation. The one idea running through all that I here present is that of reproducing, or repeating backwards, in miniature, or upon the desired scale, the precise means taken for the initial movement. Thus in Fig. 1 we have the familiar suspended lever, or it may be a horizontal lever, as we commonly use it upon an air compressor. The lever is fulcrumed at one end, and at the other end it has a fork or slot dropping over a pin fixed to the crosshead. Of course, as shown

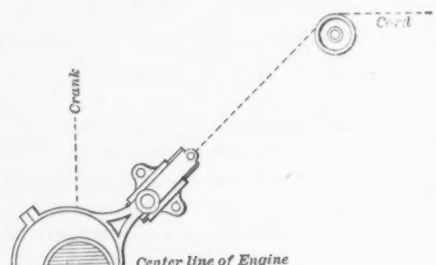


Fig. 6

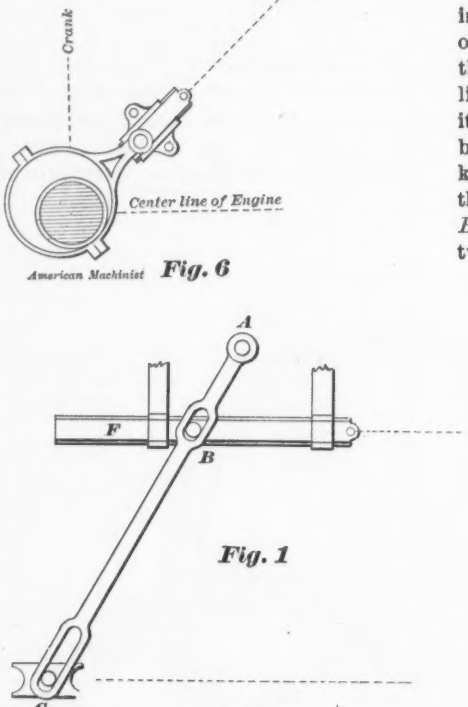


Fig. 1

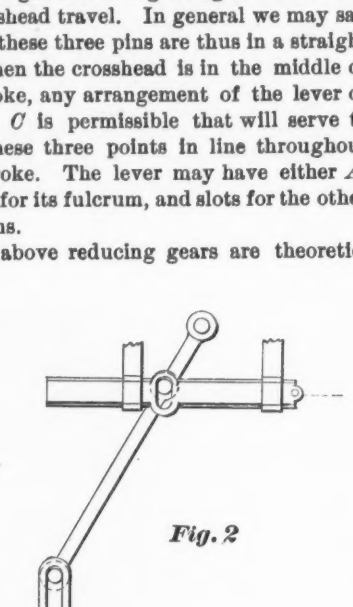


Fig. 2

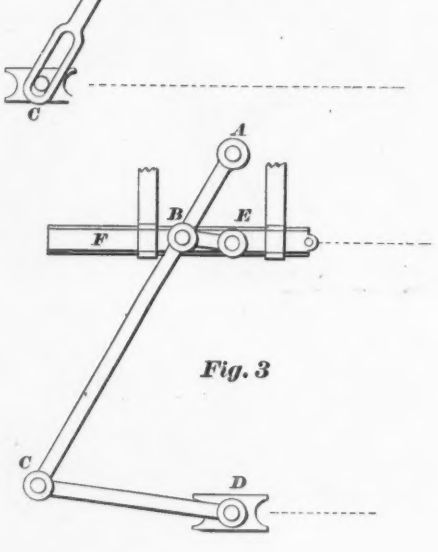


Fig. 3

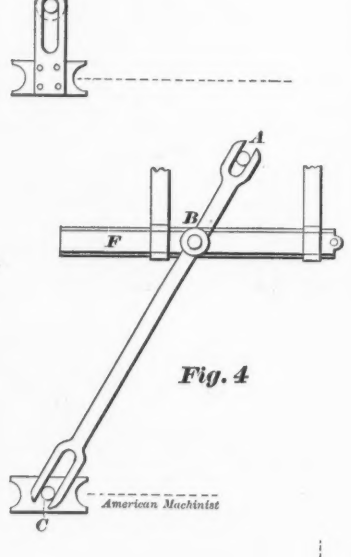


Fig. 4

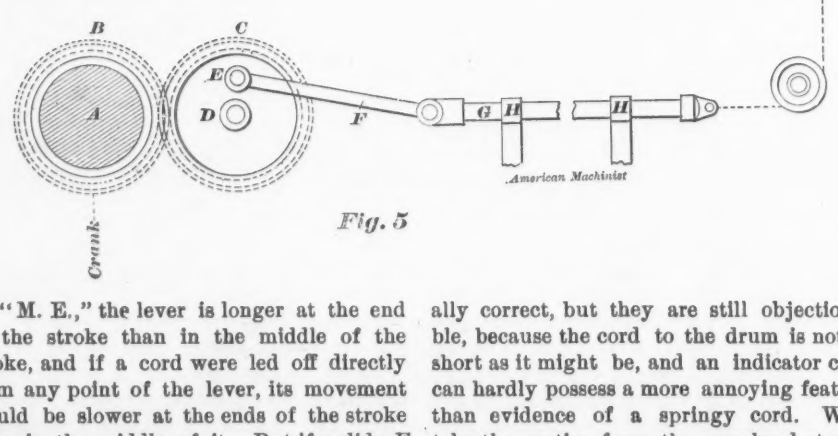


Fig. 5

by "M. E.," the lever is longer at the end of the stroke than in the middle of the stroke, and if a cord were led off directly from any point of the lever, its movement would be slower at the ends of the stroke than in the middle of it. But if a slide *F* be provided, with a movement parallel to that of the crosshead, and with a pin corresponding to the pin upon the crosshead, and if we have a slot in the lever for the pin to work in, we get an exact reproduction, upon a smaller scale, of the crosshead movement. In Fig. 2 the pins are both of them upon the lever, and the slots for the pins to work in are upon the crosshead and upon the sliding bar respectively. In Fig. 3 in place of the pins and slots we have the connecting rods *C D* and *B E*. These rods may be of any convenient length, but the ratio of the one to the other must be the same as that of the corresponding portions of the lever, or more correctly, the same as that of the corresponding levers, the lever *A B* being a portion of the lever *A C*. The proportion for the rods and levers should then be,

$$A\,C : A\,B :: C\,D : B\,E.$$

The pins upon the crosshead and upon the sliding bar *F* must be so placed that the connecting rods *C D* and *B E* will be parallel. If parallel at one point of the stroke they will be parallel at all points.

In Fig. 4 we have the fulcrum of the lever at the pin *B* upon the sliding bar *F*, and a slot or fork at each end of the lever working upon the pins. In this arrangement no care is required as to the proportionate lengths and distances as affecting the correctness of the movement, although the relative distances of the pins will, of course, determine the length of the card produced. When the crosshead is in the middle of its stroke the three pins *A B* and *C* should be in a straight line at right angles to the line of crosshead travel. In general we may say that if these three pins are thus in a straight line when the crosshead is in the middle of its stroke, any arrangement of the lever or bar *A C* is permissible that will serve to keep these three points in line throughout the stroke. The lever may have either *A*, *B* or *C* for its fulcrum, and slots for the other two pins.

The above reducing gears are theoretically correct, but they are still objectionable, because the cord to the drum is not as short as it might be, and an indicator card can hardly possess a more annoying feature than evidence of a springy cord. Why take the motion from the crosshead at all? Every respectable engine in these days is provided with a neat set of piping for the indicator as a part of its permanent equipment. Why not provide also a neat and correct indicator motion? "Reducing gear" would not be the correct descriptive term for what I have in mind, because there would be no reducing. Determine first the length of card that you want. You may make it any number of exact inches, say four, and you shall get what you want. This at the start is an improvement upon our present practice of trusting in Providence for the length, with the certainty that it will be something that no man can measure. Start at the main shaft with a crank of the required throw, the crank being usually in the form of a light eccentric, unless you can get at the end of the shaft and put a crank-pin there. Attach to the crank a rod of the same proportionate length as the main connecting rod, and let this rod *a* slide, moving parallel to the crosshead, and you have your required motion. The line of motion of the center of the pin upon this slide should, of course, coincide with the axis of the shaft.

Fig. 5 shows what this might come to in practice. On the shaft *A* we place the gear *B*. This gear drives the gear *C* of the same size turning on a fixed pin or stud *D*. On the face of the gear we have a crank-pin *E*, giving the required throw. The fact that this crank turns the other way will not affect the result if the crank is rightly placed so that it is parallel with the main crank at the ends of the stroke. The connecting rod *F*, of the same proportionate length in relation to its crank as the main rod is to the main crank, operates the sliding rod *G*. Every part will, it is understood, be light and neat and suited to the work it has to do. The sliding rod *G* may be of brass tube, with sufficient guides *H* to keep it straight. This sliding rod may extend to any length to bring the other end of it to the point most suitable for attaching the cord. By this arrangement a short cord may be used, and a convenient place for hooking on secured.

It is not imperative that the sliding rod shall be parallel to the crosshead slide. It may be placed at any angle if the operating crank be placed to correspond. It is only necessary that the sliding rod shall be at the end of its travel and its crank "on the center" at the same time that the main crank is on its center. The cranks must, of course, be both at the same ends of their stroke at the same time, both on the outer end or both on the inner end. In Fig. 6 we have the slide at 45 degrees, and the main crank at the time at the vertical or nearly mid-stroke position. The objection to the slide close to the shaft is that a long cord is required.

I have always, "in my mind," thought well of the reducing wheels. I have not used them enough to become familiar with them, but I have had some experience with them all tending to make me dislike them. The cord on the small wheel flops around and gets off, and is annoying in every way. While they are correct in theory, if a cord rides of course the leverage is changed somewhat and the resulting card is as incorrect as with some of the lever movements.

Living Wages.

The living wage conference has met, speeches have been made and resolutions have been carried, but we are no nearer a solution. A higher standard of wages and of living has been declared as necessary for a Christian country. Adam Smith said the same thing a century ago—with, however, this difference: A living wage at that time meant, and was understood to mean, a bare subsistence. We have grown since then, and have advanced in our economic theories to the point that a living wage means something beyond bare subsistence. The resolution put it at "such a wage as shall enable workers to maintain healthy and human homes." "Humane" would have been a better word, meaning something more. Professor Cunningham's resolution declared that it was to the interest of the whole community that such higher standard should be fixed, as it would tend to the best efficiency. The last resolution was in favor of conciliation and arbitration. If the conference can help to bring about those conditions, the country will be all the better for them But they will be a long time coming. The present condition is the outcome of centuries, and the evils inherited cannot be stamped out in days, or in years. These are matters of slow growth, but we are growing apace, and the rate has rapidly increased during the last two or three years.—*Engineering* (London.)

How Saw-mill Boilers are Used.

I once had occasion to visit a saw and planing-mill combined, operated by two large boilers and an engine to match, says a

contributor to the *St. Louis Lumberman*. Of course the principal fuel was sawdust as it came from the saw, and was very damp. I noticed that both furnaces were crammed with sawdust, which, as soon as it became ignited, made a tremendous hot fire, steam escaping freely from the safety valves. The fireman would then throw both the furnace doors wide open, so as to admit the cold air and check the steam; this being accomplished, the furnaces were again crammed with the damp sawdust.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Brown & Sharpe Mfg. Co. (Machinery and Tools), Providence, R. I., write us:

In answer to your favor of 9th inst., would say that for eleven months of this year the sales of our machine tools have been 6¾ per cent. less in value than during the same time in 1892. At the beginning of the year 920 hands were employed, and this number gradually increased until June 22d, when there were 1,060 on the pay roll. Soon after, the demand for tools having almost entirely ceased, 500 hands were discharged, and the shops closed during the month of August. September 1st, we started again with 541 hands and others were added from time to time till the number employed December 7th was 768.

During the year two stories of the extension to our No. 1 building, 160 feet long by 51 feet wide, have been erected and the remaining two will be added during the summer of 1894, completing the building.

Five old machine tools have been taken out during the year and 36 new ones added.

We look for a moderate improvement in business during the coming year.

The Berlin Iron Bridge Co. (Engineers, Architects and Builders of Iron Bridges, Iron Buildings, Iron Roofs, etc., etc.), East Berlin, Conn., write us:

The year 1893 has been a good year in our business—good, for the reason that we carried over a very large amount of work from the year 1892. During the first half of the year, for the above reason, we were very full of work, but it has been gradually growing less and less until now December opens with only about thirty days' work ahead, and little or no prospect of any improvement. We do not believe there will be any improvement until this tariff smashing policy of the party in power is changed, and until that time every manufacturer might just as well close his shop as to undertake to make a profit. Indeed, there is hardly a manufacturing corporation about here but what is running for the present time for the sake of keeping their help employed, to give them enough to live off from, rather than for any other reason; 1894 opens to us the darkest year in the history of our concern, and we can see no bright spots. We regret very much that we are obliged to write you a letter of this kind at this time, but we might just as well look the facts in the face, and trim our sails accordingly.

The Lunkenheimer Co. (Brass and Iron Specialties for Steam, Water, Gas, Oil, etc.), Cincinnati, Ohio, write us:

Regarding the business progress made during '93, and prospects for '94, beg to say that the year about to close has been satisfactory to us in every respect, considering the condition of affairs throughout the country. Our prospects for the future have never been so flattering as at present.

Our "Lunken" renewable seat gate valve, as well as other specialties, are becoming very popular with the trade, and the trade on same is increasing faster than we can consistently keep up with. We are increasing our facilities daily, in order to meet this growing demand.

Backus Water Motor Co., (Water Motors, Fans, Ventilating Apparatus, etc.), Newark, N. J., write us:

For the past four months business has been exceedingly dull. Since July 1st, business has practically stopped. We are building on future trade to such an extent that we are completing a new factory which we expect to move into the first of the year.

I. P. Richards (Punches and Dies for Punching Iron and Steel), Providence, R. I., writes us:

We have nothing to say in regard to business, etc., until the tariff is settled. Prospects for 1894 not very bright.

Pratt & Whitney Co. (Machinists' Tools, Forging and Finishing Machinery for Sewing Machine and Gun Manufacture, and Special Purposes, etc.), Hartford, Conn., write us:

During 1893, we have added a five story building of moderate area for the manufacture of our automatic weighers, gear tooth cutters, etc. Our orders to July exceeded those of the previous year to the same date about 15 per cent., but since that month have fallen off so much that the business for the year will be 20 per cent. less than for 1892. The number of orders grew beautifully less each month from July until September, but in October and the succeeding months a gradual improvement has been noted. Our small tool and one or two other departments are in operation six days in the week, nine hours per day, the balance of the works only five days, of seven hours each. The number of men employed is only 100 less than a year ago.

The first results of our exhibit at the Columbian Exposition, are orders from abroad for automatic screw and other special machines. We do not look for a return of the usual volume of business before 1895 or 1896.

Gould & Eberhardt (Machine Tools), Newark, N. J., write us:

We have never before been so busy, in attempting to find *some* orders, and exerting ourselves in meeting expenses out of infinitesimal profits (or none at all).

We expect to devote ourselves principally during the coming year in *continuing* improvements made in design and facilities for the production of improved first-class machinery at a reduced cost.

We have during the last year brought out three sizes of our *New Type* Eberhardt's Patent Automatic Gear Cutter, one 8-Spindle Drill, one 12 Spindle Drill Press, all tools of original design and construction, and which appear to be well received as many of our former productions have been.

Hilles & Jones Co. (Machine Tools), Wilmington, Del., write us:

While we were very busy during the early part of the year, trade fell off greatly in June and since then there has not been much business doing in our line throughout the country as far as we can ascertain. In our opinion the cause of this is not far to seek, being the uncertainty of tariff legislation under the present administration. We had a considerable exhibit at the World's Fair of heavy tools and expect to derive a good deal of benefit from it as it introduced us to a great many prospective customers and advertised the quality of our tools and our unsurpassed facilities for getting out our special line of machinery. At present there seems little prospect of any considerable activity in business and we would not hazard a guess as to the future. Meanwhile, however, we are building a number of improved new designs of labor-saving tools so that we are able to offer at all times machines fully equal or superior to any others in the market.

New Haven Manufacturing Co. (Machine Tools), New Haven, Conn., write us:

Our business for the past year has not been particularly encouraging and the outlook for the few months ahead does not appear very bright, we do not anticipate much of an improvement in business for some little time to come. We are taking this opportunity to put our works in an improved condition so as to be prepared for good times ahead. From all we can learn we have been receiving our share of what business there has been doing, and we have cause to con gratulate ourselves on having kept our works in operation until a few months ago on full time. At present we find a little improvement in inquiries, but naturally we expect at this season of the year quiet times.

American Watch Tool Co., Waltham, Mass., write us:

Business has been so very dull that there has been no "enlargement of works" or "improvement in methods." We have made slight changes in prices of labor, and production has been so small that we don't care to go on record.

Trump Bros. Machine Co. (Light Machinery, Finished Hexagon Nuts, Stud, Coupling and Tap Bolts, etc.), Wilmington, Del., write us:

From Jan. 1st, '93, to July 1st, '93, the volume of our business was largely in excess of any previous six months in the history of our Company; since July 1st, we have done practically nothing except work on stock and make preparations for some new machinery which we expect to put out shortly.

We have added to our plant during the year about $8,500 worth of new shop and special tools; one extension to machine shop 40 x 50 feet; one smith shop 28x32 feet; besides a number of improvements in and about other buildings.

As to prospects, we can only speculate; but they are most certainly not as bright as we would wish; the very decided advantage which the proposed Wilson Bill offers to the *foreign* manufacturer has practically prostrated the knitting industry in this country and in consequence the demand for our product is, for the present at least, reduced to almost nil.

We are running less than one-half force, short time but hope that the new enterprises we are working upon will enable us to increase both after the first of the year.

The National Pipe Bending Co. (The National Feed Water Heater; Also Coils and Bends of Iron, Brass and Copper Pipe), New Haven, Conn., write us:

Our business for the first six months of 1893 was larger than ever before, but the last four months has, of course, fallen off considerably and our trade has suffered with the general condition of the times. We had plans made last summer for an extension to our factory, but decided not to go ahead with it until improvement in the general condition of business. We are now paying little less prices than we were a year ago for labor, material is about the same.

Darling, Brown & Sharpe (Manufacturers of U. S. Standard Rules, Patent Hardened Cast Steel Try Squares, and Tools for Accurate Measurement), Providence, R. I., write us:

A year ago we wrote you, "The demand for our products is still greater than our ability to supply, but with additions made during the present year, and others contemplated in 1893, we expect to be able to fill orders more promptly than heretofore."

Our expectations have been realized. We are partly settled in a new building, and we have increased the number of our tools and appliances so that for the first time in a number of years we are able to fill all orders promptly and accumulate a satisfactory stock. During the coming year we shall still further extend our facilities, and add several new lines to the goods we are now manufacturing.

We anticipate a good business in 1894.

Dietz, Schumacher & Co. (Machine Tools), Cincinnati, Ohio, write us:

In reply to your favor of the 9th inst., beg to say that the business was exceptionally good with us the first six months, but dropped off considerable after that time and is now only half of what it was in the beginning of the year. We have sold almost all our old tools, and have replaced them with the most improved we could buy. We are for this reason able to turn out a great deal more work, besides keeping up the high standard of our tools, so well known to the market.

We do not feel like expressing our opinion as to the future, but feel assured that our tools will always find a ready demand.

The Lane & Bodley Co. (Corliss Engines, Heavy, Fixed Cut-off, Slide Valve Engines, Saw Mills, Hydraulic and Steam Elevators, Boilers, Gearing, Shafting, Hangers, Pulleys, etc.), Cincinnati, Ohio, write us:

We beg to say that we have made no enlargement of our works, but have put in some new and powerful tools during the year for the purpose of reducing our costs. Prices of labor at present in this vicinity are 20 to 25 per cent. lower than this time last year. There has been a constant shrinkage in prices of product. We have strong hopes of better business in 1894 than 1893, and believe it will equal that of 1892.

J. G. Timolat (Moffet Portable Drill), New York, writes us:

We take pleasure in stating that the sales of the Moffet portable drill for the year about to close have far exceeded our expectations, in spite of the general depression in business. We think that this continued demand is partly due to the fact that this year we have made some very important improvements in this tool, which are the result of the experience gained from its use for the past three or four years. These improvements greatly increase its labor saving qualities and more than double its power, so that now holes can be drilled in steel, wrought or cast-iron from ⅝" to 2½". The internal construction has also been changed in such a manner that economy in the use of steam and compressed air is secured.

Notwithstanding that these improvements have considerably increased the cost of the drill, the price remains the same. Many of our old customers, upon hearing of the changes which have been made, have written us, and at once adopted the new drill—although we have received from them highest testimonials for the old style drills which they had used for a number of years.

Montgomery & Co. (Tools, Supplies and Machinery), New York, write us:

From January 1st until April 1st we had all the business we could possibly take care of. We never had so many good orders, in fact it was no trouble to sell anybody, people bought on sight, but from April 1st up to the present time it is an entirely different story, never had so few orders, and never was it so hard to sell to people.

As to what the causes are, and as to when business will be better, we prefer to say nothing. We have made up our minds to keep quiet, express no opinions as to when things will be better, but simply wait.

However, we sincerely trust that confidence will soon be restored and that things will be better.

Worcester Machine Screw Co. (Set, Cap and Machine Screws in Iron, Steel and Brass, Studs for Steam Engines, Pumps, etc.), Worcester, Mass., write us:

We have but very little to say in reply, as this has been an off year with all manufacturers. The first six months showed the largest business we had ever done. Since then our business has fallen off very much, owing of course to the general depression in business. We have not enlarged our works, during the past year, and have nothing new to note in our methods of production. There has not been any change in price of labor, and scarcely any in materials, as the class of stock which we use is not affected much by the price of market iron. Neither has there been any change in the price of our product. What the prospects are for 1894 is something we cannot foretell, although we are looking for a gradual improvement after Jan. 1st, and we hope to see a good business in early spring.

James A. Taylor & Co. (American Standard Gauge and Tool Works), Wilmington, Del., write us:

We have little that is encouraging to report for the present or near future. Our clients restrict wants as never before, replacing only what is worn out. Some additions were made early in the year.

Bickford Drill and Tool Co. (Fine Machine Tools, Upright, Radial, Universal Radial, and Multiple Drills, Boring and Turning Mills), Corner Front and Pike Streets, Cincinnati O., write us:

The first six months of the present year have been without any doubt the most prosperous which our firm has ever experienced; orders were plentiful and collections very satisfactory. With the last six months, however, business has dropped off to less than 50 per cent. of the previous half year. At the present time matters are in a very quiet state, and we cannot report any improvement in business, and judging from the now existing conditions the outlook for the beginning of 1894 at least is not very encouraging. Owing to the healthy and prosperous business of the first half year we erected an addition to our shop and also remodeled the old plant so as to enable us to do still greater amount of work. We also purchased in the early part of this year quite a number of new tools, but, of course, our expectations from our new improvements have not been realized owing to the depressed condition of trade. We have during the past year made decided changes in the manufacture of our product and have specially given the manufacture of multiple drills a great deal of attention. We enjoyed a very nice trade on these machines before the dull time set in. We have at the present time several new machines under way, but do not feel we should complete them until matters appear a little brighter. In accordance with the drop in business we were obliged, of course, to reduce our working force and also our working time which condition still remains unchanged at the present writing. We have not, however, made any reduction in wages, and are still paying our employes the same money as in previous times. The prices of machine tools, however, continue to have a downward tendency which fact is caused by the sharp competition in this line. The materials used in the manufacture of our goods still cost us the same, and very little reduction has been made in this line. In conclusion, we wish to say that we, of course, hope for an improvement and are ready for it in every respect, but must say that we cannot see where a speedy remedy for the now existing evil is to come from.

J. T. Slocomb & Co. (Machinists' Tools), Providence, R. I., write us:

Our business was good this year up to about the 1st of July; since then it has been very dull. We do not, as yet, see much improvement, but are in hopes, and believe we have some reason to think that the 1st of January will bring a change for the better.

So far, we cannot say that the dull times have been of any disadvantage to us. We have improved the time in constructing some much-needed special machines for use in our line of manufacture, so we feel, at present, that we would not like to exchange what we have for what we should have had, if business had held good throughout the year.

We are pleased to notice that we are making some headway in introducing our specialties.

Our combination center drills, although they look about the same as at first, are, in fact, quite a different tool. We have made changes in their manufacture, which has improved the quality greatly, so we are now doubly in earnest about being able to furnish tools, that are not only cheaper, but better, than anything else in existence for the purpose.

Cleveland Twist Drill Co., Cleveland, O., write us:

Up to the first of July of this year our business was very largely in excess of any previous year. We ran our factory full time with all the men we could work in it, but we were not able to keep up with our orders. About the first of July when the financial panic was sweeping over the country, we were unable to collect enough money to pay our men, and were therefore obliged to close the factory for about three weeks; since then we have been running eight hours per day with from one third to one-half our full complement of men. Since the middle of July orders have been light, and none of our customers have been laying in stock, but have simply purchased such tools as they had immediate sale for. We have added to our list of tools during the year our handy snap gauges and common sense boring bar, both of which have been illustrated in your columns. We expect to add a few other novelties during the winter, illustrations of which we will be pleased to send you forward. We think that business in '94 will be good, and prices in our line will not be any lower. There are no changes in prices in raw material and labor.

The Skinner Chuck Co. (Skinner Patent Chucks, Independent, Universal and Combination Lathe Chucks, Planer Chucks, Drill Chucks, Face-plate Jaws, etc.), New Britain, Conn., write us:

We have to say that business has been quiet with us for the last few months. The year opened with increased business prospects, and orders for the first few months were fully one-third greater in amount than those of the previous year. In consequence of this favorable outlook we put in new machinery and made arrangements for manufacturing a largely increased line and variety of goods. We have added to our line, the current year, a "new model" drill chuck which is finding ready sale, both in this country and Europe, an improved planer chuck, and new and improved face-plate jaws. By obtaining the best machinery, employing skilled workmen and using the best material, we have endeavored to produce the very best machines made. We have received some new patents, the last one being issued in November last, and we now have greater facilities for filling orders promptly than ever before. For the first few months of the year we were unable to keep up with our orders in some lines of goods, but business has fallen off since the first of August, and during the autumn has been very quiet.

There has recently been a reduction of 10 per cent. in price of labor, in part of the works, and some reduction in hours. If the dullness continues many months it seems as if further reduction must be made, or business be continued at a loss, but we are hoping that with the opening of the new year prospects will be brighter, and that an improvement in business conditions will be noted.

Perkins & Co. (Perkins' Patented Perfected Shingle Sawing Machinery, etc.,) Grand Rapids, Mich., write us:

Our business for the first six months of this year was exceptionally fine, running our shop night and day with full crew. Since then we have been making up for our extra work by cutting off men and shortening up the hours. Our trade is materially affected by the present policy on the tariff as we interpret it, for to nothing else can we understand why we have no trade, why lumber should be depressed in the market and the lumbermen all feeling blue.

The worst of it is we can see no light on the horizon, for if the Wilson bill passes, as we figure it, the immense forests of Canada will be thrown into competition with the American forests, which have been depleted by the enormous amount of lumber cut annually for many years past. There will be unquestionably a large number of mills built in Canada, but there is a duty of some 30 per cent. on our goods, therefore we would be practically barred out from exporting our goods to Canada to supply the wants of the mills there. At the same time our lumbermen will not build any mills to speak of here. Therefore we are getting it on both cheeks, according to the Bible doctrine.

Every industry in this city seems to be paralyzed. The number of men unemployed at the present time has had no precedent in the history of our city. All philanthropic societies in the city are doing their utmost to raise money and secure food and provisions and take care of the unemployed and their destitute families.

We hope that the tide will change soon, although we can see nothing in the policy promulgated by the present party in power to change it.

P. H. & F. M. Roots Co. (Positive Pressure Blowers, Portable Forges, for Foundries, Blacksmith Shops, Ventilating Buildings, Mines, etc., Gas Exhausters and Fittings, Fire Beds and Tuyere Irons), Connersville, Ind., write us:

Our trade up to September 1st was extraordinarily good. After that time we had sufficient business to keep our regular force of employes at work, and notwithstanding the financial and trade disturbances our business since September 1st has been equally as good in proportion. The outlook for the coming year is very flattering.

During the past year we have made a number of valuable improvements in our blowers and machines for manufacturing parts of them. We now have a machine for finishing the revolvers or impellers of our blowers and exhausters that enables us to turn them out more rapidly and uniformly than before. Any other style of impeller can be finished on the same machine, and it is our purpose to furnish any other style of impeller when desired by customers. Our present equipment enables us to adopt this broad plan of manufacture.

Millers Falls Company (Hardware Manufacturers), New York, write us:

We have to report about our usual amount of business. The home trade is smaller and the foreign trade larger than in former years. We are running full handed, and mostly at the old rate of wages. Foreign woods which we use have advanced in price, while other stock has a downward tendency. We have put in a few new machines such as were needed to get out our new lines of goods. The power hack saw which we advertised in your paper is having a great run all over the world, and our hack saw blades have much increased in demand.

The Fox Machine Co. (Wood and Iron Working Machinery), Grand Rapids, Mich., write us:

We will state briefly that during the first six months of 1893 our business was never better. Everything was running very nicely until the first of July when the bottom seemed to drop out of everything. Our sales in July were only about one-fourth of what they were in June. There has been a gradual increase from that time to the present, but the outlook is not very flattering. There was one thing in our favor and that was we had no stock on hand; in fact, we have never been able to accumulate a stock in any line until the present time.

We have been running 8 hours a day with nearly a full force since the first of July and have sold a very fair amount of goods. The difficulty, however, has been the expense of selling, which has been all out of proportion to the selling price of the goods, which has made business very unprofitable.

Our exhibit at the World's Fair has been a splendid advertisement from which we have taken orders for a large number of small tools, and we are confident that had the situation of business been the same as it was a year ago we would have sold at least ten times the amount. The value of the exhibit, however, cannot be over-estimated, and we are continually receiving orders which came as the result of purchasers examining our tools at the time.

We have improved all of our trimmers within the past year and a half, adding some new styles, all of which we find are highly appreciated by our customers.

We entered a new line of business a year ago—the manufacture of steel sash pulleys, and notwithstanding the fact that it was an entirely new article, we sold over 100,000 of them during the first six months of last year. The outlook for 1894 in this line is most encouraging.

Our machine tool business has been very quiet, although we have had a fair trade on our 15 inch crank shaper during the past year.

In the way of new tools we have placed on the market are our arbor press and two-spindle milling machine. This machine being such a radical departure from anything in the machine tool line that we were a little in doubt as to its utility. A year's experience with it in our own works has fully demonstrated it to be far in advance of the ordinary single spindle machine; and we expect a good trade on this if there is any business to be had.

We find the price of raw material to be a little lower than a year ago. This is also true of the price of labor. At the present time the greatest drawback to securing orders seems to be the unsettled state of business on account of the expected tariff legislation. While a revision of the tariff may be desirable the way it is at present agitated is certainly detrimental to the business interests of the country, and the uncertainty of what the outcome will be is preventing the return of the prosperity for which we are all so anxiously looking.

W. D. Forbes & Co. (Engineers), Hoboken, N. J., write us:

As to the business of '93, up to July, it was very satisfactory; just now very few orders are being actually placed, but still there is something doing.

We have taken up the manufacture of the "national" chuck for Mr. William Whitlock, and are organizing a department for its manufacture; this will keep us moving for some time. We have hopes for '94 because no one has anything ahead, and somebody will want something by and by.

As to changes in wages the inclosed we issued to our men and it explains itself:

"W. D. Forbes & Co. has taken into careful consideration the question of a reduction in wages on account of the business depression and have determined not to make any such reduction, but to make the following statements which, we believe, will be understood and acted upon by all employes, and result to our mutual advantage.

"No amount of personal supervision can effect the saving in oil, waste, material, etc., which can be made by employes themselves, and it is earnestly requested that all our men and apprentices assist us to keep our present force running by careful economy.

"It should be remembered that work must be got out with the utmost dispatch, and that a man trying to prolong work will find it likely to result in the loss of his position and the closing of our doors.

"Every one in our employ must assist us by doing all the work possible, and those who show the greatest care and interest in our work, will be those whom we will retain the longest."

Chandler & Taylor Co. (Engines, Boilers, Saw-mills), Indianapolis, Ind., write us:

During the past four months trade has been so fitful that it has been a difficult matter to make any satisfactory estimate in regard to the future. It is our opinion that machine men may count on no great amount of business before February 1, 1894, and it is a matter of very grave doubt in our own minds whether they will get it then.

We have made only trifling enlargements in our works during the past six months, and while the price of material is lower than it has been for some time, there is but a limited demand for machinery.

Detroit Foundry Equipment Co. (Whiting's Improved Car Wheel Foundry Plant, General Foundry Outfitters), Detroit, Mich., write us:

The business of this company was excellent up to the time of the panic, and continued very fair indeed to within the last two months, we having been fortunate enough to have secured a very fair-sized order which kept our works and men employed during the severest times in the past fall. We think for the last three or four weeks people have had a tendency to buy a little freer and to consider purchases for new enterprises and repairs that were contemplated and considered away back in April and May. During the last ten days, however, things seem to have dropped back to a very disagreeable dullness. We find many people very blue over the tariff contemplated changes, and our impression is that if this question is not settled one way or the other, the fear of a change coming on at any time will affect the season of 1894, so that business will be very bad indeed.

It is entirely beyond our comprehension why the Government of this country should not give all aid possible to stimulate business after the country has gone through one of the most terrific trials it has ever witnessed. The introduction of the tariff subject is entirely antagonistic to the methods that should be employed to advance confidence and trade, and it would seem to us as though the idle men, who, in so many cases are suffering the severest tortures of starvation and inability to provide for their families, also manufacturers, mine owners and producers of all description, would raise such a hue and cry that one immense petition would be sent to Congress asking that they let the tariff alone for a short time, giving people an opportunity to regain the immense losses that have been met recently. "How much can we discourage the American people?" seems to be the thought at Washington, whereas nothing is needed so much as encouragement and confidence in people and our Government.

S. M. York (Machinery and Engineering), Cleveland, O., writes us:

From the extensive correspondence we receive, I think that the country is very hungry for goods, but profits are out of sight and likely to be so for some time to come. Parties seem to want something cheap or second-hand to get along with, for which they cannot be blamed, as every tendency seems to be toward lower values, lower wages and closer competition, and while it may have seemed unnecessary to forestall these events as the struggle must have come eventually, it is my opinion that much suffering could have been avoided by handling the matter with more wisdom, and the great shock to the industrial world and continued depression obviated.

A comparison of our gross sales of '93 shows for the past four months almost exactly one half those of '92, which were about 10 per cent. greater than '91, and we don't anticipate the old volume of business of even '91 for the coming year. A retrospect would seem to show that we hardly appreciated our favors and growing trade ending last June.

The Lodge & Shipley Machine Tool Co. (Engine Lathes, Drills, Turret Lathes, Shapers, Pulley Machinery, Cylinder Boring Machines), Cincinnati, O., write us:

Our business from January 1 to July 1, 1893, showed a steady growth. The four months following we did little. Immediately following the elections throughout the country we booked quite a number of orders, and although we continue to receive a fair number of apparently good inquiries and have "prospective customers" yet purchasers show considerable temerity in placing orders. We continue in the same line, viz., "Machinery for the rapid production of lathe work," our leading machine being our "Double Saddle Turret Lathe."

We notice some inclination of labor to offer for less than we have heretofore paid and also some change in the prices of material. Our shops are now running at about half our force of July 1st, and we anticipate a slow revival of trade.

The Burr & Houston Co. (Soft Castings for Machinery, Electric Work, etc.), Brooklyn, N. Y., write us:

In regard to the business of 1893, we can only say that like every one else that we know of, we have suffered from the depression of business during the last six months. As to 1894 we can only say that from our standpoint we can see but little encouragement for the future until the tariff issue is settled, and not much encouragement then, if the Wilson bill passes, or one similar to it, which will make a big cut at our manufacturing interests.

E. G. Smith (Beam or Sliding Calipers, all sizes and styles, with or without vernier. Surface Gauges, Micrometers, Fine Steel Squares, etc.), Columbia, Pa., writes us:

My business during the first half of 1893 was encouraging, but has been falling off until November, which I suppose was due to the general depression. Since November my sales have been gradually improving, and the outlook for 1894 is very encouraging, judging from present conditions. While the depression lasted I added several new tools, such as metric micrometers, and metric vernier beam calipers with clamps and screw adjustment, and calipers reading $\frac{1}{1000}$th of an inch, which I heretofore only furnished to order; I carry in stock and am now in a position to fill orders promptly.

I have furnished, during the year, lots of fifty and more of my vernier calipers to single shops, as well as filled orders for colleges and manual training schools.

Wiley & Russell Manufacturing Company (Manufacturers of the Lightning and Green River Labor-saving Machinery and Tools), Greenfield, Mass., write us:

Replying to your inquiry, business for the first half of the year was as remarkably good as for the last half it was bad. Though six months have passed, it seems to us yet too soon to judge what the permanent ef-

fects of the great collapse of June are to be. We are inclined to hope that when the shock of the panic has been recovered from, we may go on very much as before—that the stream has only been checked for a time. Certain it is that a manufacturer of tools cannot rest—being like the snake whose tail must wiggle till sundown, however much it is killed—and our orders during the last season, if very unsatisfactory in volume, have been almost as numerous and quite as urgent as ever. We have, moreover, regarded the slack time as an opportunity to put machinery and tools in the best order, to sort up our stock, and to bring forward new attractions. Our catalogue for 1894, just ready to publish, will show that we have used the time to good advantage. We have never been able to offer so many novelties and improvements in a new catalogue before, and we look forward cheerfully to the spring trade.

J. H. Dunbar (American Packing Rings), Youngstown, O., writes us:

Replying to yours of 9th inst. say that I cannot report the demand for my specialty as brisk as I could wish, but I share the hope of others that the future has something better in store for us.

It affords me pleasure to state that my recent "ad" in the AMERICAN MACHINIST has been seen in Europe and responded to.

G. W. Jordan (Jordan's Improved Planer Chucks), Worcester, Mass , writes us:

My trade from January 1st till July 1st was first class, but from July to December 1st it was very small, but has improved very much during this month. Prospects for '94 are good.

Henry Carey Baird & Co. (Industrial Publishers, Booksellers and Importers), Philadelphia, Pa , write us:

While 1892 was not a particularly prosperous year, we have during the present year experienced a falling off in business, and do not look for any improvement whatever during the year 1894.

The enormous contraction of bank loans by the National banks between May 4 and October 3, 1893, of $310,709,177, resulting in the annihilation of deposits to the amount of $298,434,896, is an event of profound significance. It is without a parallel in the history of finance in the world, and bad as have been its results to the country, no other country on the face of the earth could have stood up under it as well as this country has done. At no previous period in our own history could we have passed through this terrible ordeal without vastly greater disturbance and ruin than we have experienced. The coinage of silver and the issue of silver certificates and silver Treasury notes since 1878 have infused such an amount of vitality into the country, have resulted in the accumulation of so vast an amount of wealth (merely labor power utilized) that a large body of men have succeeded in getting themselves out of debt and therefore beyond the possibility of ruin. This prevents much bankruptcy which would otherwise inevitably have taken place; but enterprise is largely extinguished.

What little enterprise remains, the democratic politicians in Congress, headed by Professor Wilson, propose to destroy by holding over the heads of the people the drawn sword of a British free trade tariff, which must, if enacted, destroy a large part of our industries, and reduce prices. Few men are likely to go into new enterprises, few are likely to buy and produce except for immediate wants at high prices when lower prices are inevitable. In a word, the future to the American people looks dark indeed, and almost every one recognizes this fact, and such recognition must result in stagnation and death.

A. T. Shoemaker (Railway Supplies and Equipment), New York, writes us:

The geometric boring and turning tool which I am introducing here and abroad is fast gaining friends by its performances in doing such perfect work, which it not only does accurately but quickly as well.

We are getting inquiries from all quarters of the globe, and think in the near future the tool will be generally adopted in shops.

A. D. Quint (Six Spindle Turret Drill Press), Hartford, Conn., writes us;

My business, the manufacture and sale of the turret drill, up to the 1st of June was better than in 1892, since that time it has been quite dull, with but few domestic orders. My export trade has continued good. I have neither enlarged my works or made any change in the price of labor or product. Cost of material remains about the same as last year. I was an exhibitor at the World's Fair, but have not yet received the benefit from the exhibition that I expected, owing, I think, to the financial panic in the spring followed by the general depression in business. I look for better times after the tariff question is settled. I am now experimenting, and expect to bring out a larger size drill in which the users may have from two to twelve spindles or any number they may wish.

The Meriden Machine Tool Co. (Forming Lathes and Special Machinery for Economical Manufacturing), Meriden, Conn., write us:

We were very much pushed for our forming lathes during the first half of 1893, but the last half has been very quiet.

We find, however, during December a very noticeable increase in the number of inquiries, and this leads us to anticipate an improvement early in 1894.

We added some machinery to our plant early in the year, and have taken advantage of the later dullness to improve our methods, and get ready for the increased demand which we feel must come before long.

The J. T. Case Engine Company, New Britain, Conn., write us:

Notwithstanding the widespread depression of business, the results of the year show a very marked increase over those of any previous year.

The Case engine is rapidly making its way in the electrical field, possessing advantages for direct connected work which we believe no other engine on the market has. The popularity of this method of dynamo driving for small isolated plants, and especially for boat work, is rapidly increasing.

It is our intention to materially increase our facilities in the coming year, the first step being the addition of a 100 H. P. boiler to our steam plant; and we shall without doubt add considerable machinery before June 1st.

The Acme Machinery Company (Bolt, Nut and Special Machinery), Cleveland, O., write us:

We were very busy during the first four months of the year just closing and fairly so until July, so that the output for the first half of the year was ahead of that of the preceding year by quite considerable. In the last six months however, business has been very dull, but the outlook now is a little brighter, as we are receiving more inquiries again, which seem to warrant the hope of an early change for the better.

Philadelphia Engineering Works, Limited (Philadelphia Corliss Engines), Philadelphia, Pa , write us:

During the first two months of this year we were fortunate enough to secure orders amounting to three-quarters of the total business we did the previous year, and from indications we felt assured of a very large year's business. During the succeeding three or four months, up to the 1st of June, our orders received were in about the same ratio as the first two months. The general depression, which swept the entire country however, resulted in our failing to secure orders of any consequence. In fact we secured but little work during July, August and September. Probably 10 per cent of what we formerly secured.

During this period, however, we have made a number of improvements in our works, getting up special tools for the more efficient and economical production of our machinery.

At the present time we have inquiries for quite a considerable amount of work, which will undoubtedly materialize about the 1st of January. The indications are that we will have a fair volume of trade at low prices. The strong competition brought about by this depression has induced us to make a reduction in the price of machinery, which, in part, is made up by reductions made in our working force, materials which are required, etc.

Joseph Dixon Crucible Co. (Crucibles, Graphite Paint, Pencils, Lubricants, etc.), Jersey City, N. J., write us:

The first half of 1893, was the best season the Dixon Company ever had. The succeeding five and a half months have been as bad as the first six months were good.

Since the first of July in common with the rest of the business world, falling off sales, increased bad debts, slow collections, keen competition, keener than ever for what little business was left.

The outlook does not promise a quick recovery. Retrenchment is the order of the day and the spirit of economy is on the whole people. Not before '95 and '96 will this seriously change.

Many letters stand over, to appear next week.

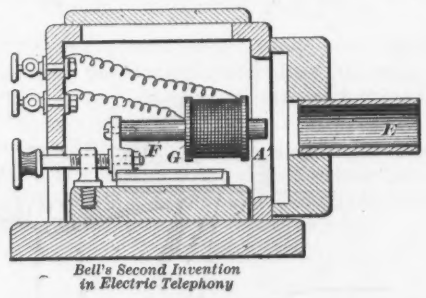
Practical Telephones Soon Free.

BY S. W. BALCH.

The wise operation of our country's patent laws will this month make practical telephones free from patent monopoly. The broad patent to Alexander Graham Bell on the method of transmitting speech by electrical action ceased to exist in April of last year. It was illustrated by an apparatus that was not well suited to the transmission of speech, and consequently when the monopoly granted by the patent expired, this original construction did not come into use, and so, while in theory the broad monopoly then ceased, yet since all practical forms were still covered by later patents, no practical public gain resulted.

Bell led all others in the task of devising a practical form for the telephone, and disclosed the results of his invention in United States Patent No. 186,787, on January 30, 1877. His apparatus consisted simply in two mechanical structures, just alike, one being at one end of a circuit, and the other at the other end. Their construction was essentially the same as the ear-pieces of the present telephones, with which every one is familiar. As then suggested, however, it was proposed that the same instruments be employed both to convert sound waves into electric waves, and to change the electric waves back into sound waves; that is, both to speak into and to listen at instead of for the latter purpose merely, as at present usually employed.

The accompanying drawing shows the apparatus as it is illustrated in Bell's second patent. In its combination of the diaphragm *A*, coil *G*, and permanent magnet *F*, no change has been made after seventeen years' experience, and the main difference to be



Bell's Second Invention in Electric Telephony

noted between the form given in the patent and the receiver as now constructed, is in the change of the outer casing to the present slender form. In the original patent a magnet that was horseshoe in form was also shown. It presented two poles to the diaphragm, and each of these was provided with coils of wire. In the drawing here reproduced the form with one pole and coil is illustrated. The horseshoe form is generally conceded to be superior magnetically, and is, therefore, quite likely to come into use in the future, although for use in connection with the carbon transmitter the simpler single-pole form has been preferred by the Bell Telephone Company.

The patent for this invention, like all others, is a compact between the people of the United States and the inventor, by which he has, on the one hand, produced and disclosed something of use, which, but for his thought and labor, would have remained unknown. The agreement on the part of the Government is to assist the inventor in preventing all others from competing against him in the manufacture, use, and sale of his invention anywhere in the territory of the United States during a period of seventeen years. Aside from any such agreement, this right is unquestionably the inventor's privilege to maintain by keeping his invention a secret. Having produced it by the exercise of the divine faculty of invention, he has become possessed of a species of property hitherto unknown, and, if it does not become the independent invention of another, by keeping it to himself he will be its undisputed possessor as long as he lives, and generations after him, to whom the idea may be given or sold, can by maintaining secrecy continue the monopoly.

The compact which the Government makes with the inventor is a tender for seventeen years of the services of the law to restrict the enjoyment of the invention to the inventor, and those to whom he may assign it, while he enjoys it openly and as he could have done of his own motion by keeping it a secret.

In exchange for this exclusive grant the inventor must make public the invention to which it is to apply, so that when the patent term is over the invention will thenceforth belong to the public.

This patent protection on the magnetic telephone, having commenced to run on January 30, 1877, will cease on January 30, 1894, and the rights, which prior to this latter date belong to the owner of the patent, will thenceforth be the rights of the public. They are now the property of the American Bell Telephone Company, and its ownership of them is asserted in an advertisement which it keeps standing in a scientific publication.

In it the following definition concerning this patent, which is about to expire, is quoted from the Supreme Court of the United States:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm made of flat iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet as described, with a coil upon the end or ends next to the plate; the sixth, of a sounding box as described, the seventh of a speaking or hearing tube, as described, for conveying the sound; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things, or any of them, are used."

This invention has proved an essential feature of every successful electric telephone system that the combined inventive genius of the world has succeeded in devising and extensively exploiting. Its importance to the Bell Telephone Company is well shown by the above quotation from the Supreme Court, and this importance is particularly interesting just now to the public, since it is to become, on the thirtieth of this month, the joint possession of all the people of the United States, and practical telephones will be free.

The expiration of this patent probably will not open to unrestrained public use, telephones that are much in advance of the stage of development represented by the instruments described in the patent, and they will hardly be serviceable for communication between one town and another, but for the short distances over which the great bulk of telephoning is carried on, they will be of practical service. Every one will then be at liberty to put up private lines connecting his home with any one of his neighbors or his place of business, if it is not far away, and the total expense for instruments that will be his for all time need not exceed the present rate of telephone rentals for ten days in the city of New York. Of course such a telephone would not be one over which messages could be sent in a whisper; it would not include the service of a vast army of "hello" girls ready day and night to connect your telephone in an instant with any one of fifty thousand other telephones from Massachusetts to Wisconsin, and the telephone on account of existing patents would necessarily have to do without some other conveniences to which telephone users are accustomed. However, on and after the thirtieth of this month the public will be free to make use and vend, and there will, without doubt, be many that will be ready to sell telephones that will, in a large measure, answer the public needs.

In so doing, however, it will be necessary to avoid the use of all telephone accessories which have been added to this invention of Bell's, and which are the subject of patents belonging to the Bell Telephone Company that have still several years to run. These

are patents for various ways in which the connections are automatically changed between the telephone and the signaling apparatus; patents for transmitters that magnify the electrical waves, and patents for the construction of telephone exchanges. These are mostly owned by the American Bell Telephone Company, which will doubtless enforce all the rights that their patents confer.

In devising a telephone line that will infringe no patents, those on telephone exchanges will not need to be considered if two parties only are to be connected. By using only the ear-piece to speak into, and using no description of transmitter that will increase the sound, will probably be the only way to avoid the lawsuit which the Telephone Company threaten to bring if their patents are infringed. It will also be necessary to do without the automatic switch of the Bell telephone, and if there is any automatic switch that can be used in its place, it will doubtless be proven only at the expense of a lawsuit against some one.

It is very necessary to have a call bell in conjunction with the telephone, so that a person at either end can attract attention at the other end. This may be operated by a current from a battery over wires independent from the wires connecting the telephones, and a switch avoided. But it may be desirable to call and telephone over the same wire in order to save the cost of an extra line, but if this is done, and the telephones and call bells are connected in the same circuit, the telephones will offer needless resistance to the current that is sent to ring the call bells, thereby requiring extra batteries, and the call bells by their resistance will diminish the telephone currents. This can be avoided by connecting only one of these at a time at each end of the line by a switch. There is one great drawback to the use of a switch, and that is that it may be left wrong, and many ways have been devised and patented to prevent it. These are patents for operating the switch by the weight of the receiver; patents for pushing over the switch in hanging up the instrument; patents for switches mounted on the ear-piece, and turned by gravity accordingly as it is held horizontally to the ear or hung up vertically. Whether any automatic switch will be discovered and brought forward, therefore, remains to be seen, but it doubtless will, if such a switch is found to be possible in any form not already patented.

Beader, or Device for Forming Beads in Molds.

The accompanying illustrations show a device and its details for forming beads in molds, recently brought out by T. F. Harris, Bessemer, Ala. Its construction is very simple, as will be seen by the following description. The mold *M* is shown as resting on the chill plate *C*; the latter is bored to receive the toggle joint *t*, links *a*, and the crank plate *B*; the sleeve of the latter turns in the guide plate *G*; through this sleeve the square shaft *d* slides. The rollers *r r* turn on the pivots *p p*, which are shrunk in the outer ends of the toggle joint; the center of the latter is connected to the square shaft *d*.

When the beader is to be put in operation, the handle *H*, and consequently the shaft connected to it, is pushed upwards, thereby placing the rollers in the position as indicated by the full lines, then by giving the handle two or three revolutions, the bead in the mold will be formed. When the beader is to be removed, the handle *H* is drawn down, and the rollers assume the position as shown by the dotted lines.

This tool will undoubtedly be found very useful in foundries where water pipes, gas pipes, etc., are cast.

This is the way a New York reporter announces a smoky chimney: "As a matter of fact the smoke was there before the observer put it down. It started early in the day and continued until darkness hid it. In the afternoon its tail was dangling around the northern end of the Post Office, and switching itself back and forth in a saucy fashion as though inviting the Mayor to come out and see how much the steam company cared for the city authorities."

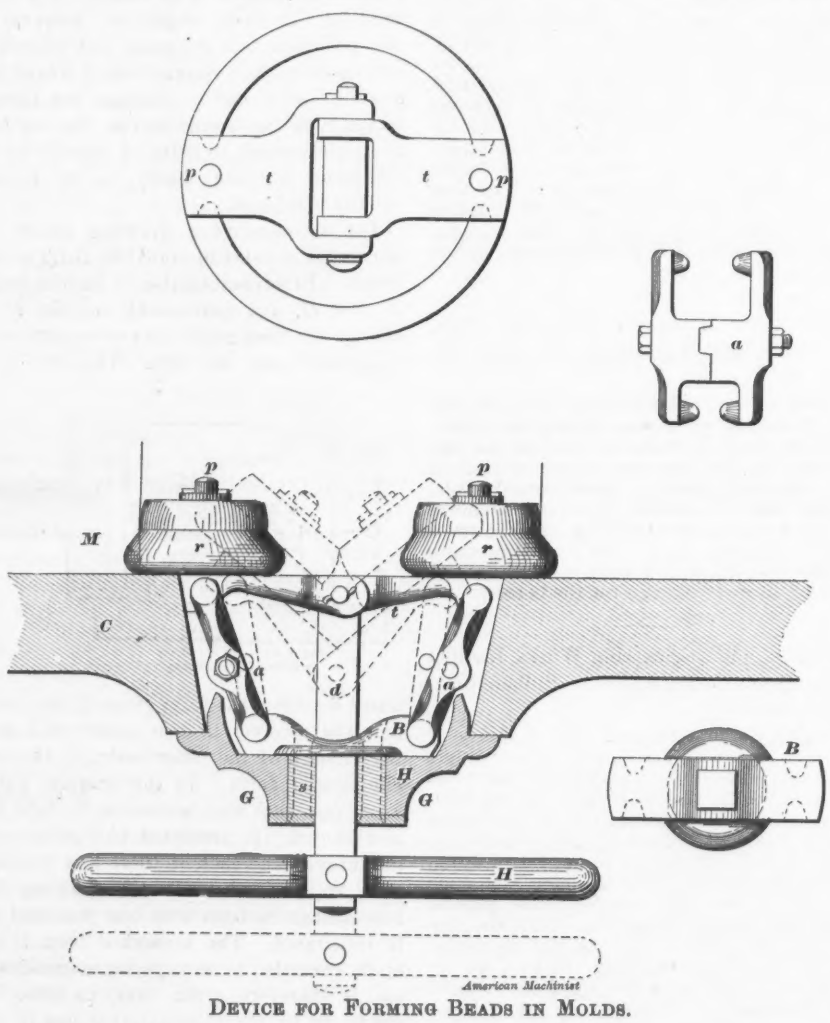
LETTERS FROM PRACTICAL MEN.

Limiting the Time a Boiler Should Be Used.

Editor American Machinist:

At the November meeting of the American Society of Mechanical Engineers, in 1881, at the Turf Club Theatre, New York City, the writer read a paper entitled "The Lifetime or Age of Steam Boilers." (See volume 2, pages 503–524 Transactions American Society Mechanical Engineers.) In this paper the writer took the ground that a law should be passed limiting the maximum number of years during which a steam boiler may be used.

A boiler near Philadelphia exploded killing eleven persons. The boiler was *twenty years old*, and had been in use for that entire period, and the iron at the point of rupture was but *three-sixteenths* (0 1875) *of an inch thick*, and when new it was *full one-fourth* (+ 0 257) *of an inch* thick. The reduction by *wearing away from age in twenty years* was *fully one-sixteenth* (— 0.0695) *of an inch*. The owners stated that *it was thoroughly repaired and inspected just before the explosion and pronounced all right.*



DEVICE FOR FORMING BEADS IN MOLDS.

In the case of the recent Dry Dock, East Broadway and Battery Railway Co. boiler explosion, on Nov. 2d, in New York City, it is reasonable to assume that if such law of limitation had been in force such explosion would not have occurred and the destruction of life and property caused by the explosion would have been prevented.

The boiler above referred to was made by a skilled boiler constructor and no doubt was made of excellent material, but it had been in use for upwards of twenty years, and beyond doubt its area or thickness, consequently its strength, had been greatly reduced by such protracted use, hence the explosion. And this explosion enforces the argument in favor of the enactment of the suggested law.

It is no answer to this to say that the enactment and enforcement of such law would result in expense to boiler users, in view of the fact that the question concerns human life.

I am aware that no arbitrary rule can be established applicable alike to all boilers, and fixing a uniform and single term for their use, for the safety limit will depend on the designs, construction, quality of material and character of workmanship of the respective structures. But certainly engineering ability, in view of known facts, is equal to the task of suggesting remedied legislation that will throw additional safeguards around life and property.

I am aware that new boilers have exploded the cause of which would have become patent had proper inspections and tests been made. Under the strict inspection law of the city of Philadelphia and a time limit as to the use of boilers, explosions would be a thing of the past. It has been claimed that the late large adoption of water-tube boiler would obviate explosions, but the number of lives lost and destruction of property by this type of boiler shows fully as many as those of shell boilers. The ordinance department of the United States and the railroad companies condemn and remove guns, axles, etc., after a stated time, *no matter what* their *apparent condition may be*. The saving in lives and repairs to vessels, machinery, cars and road-bed has emphasized the truth of the old adage, that "an ounce of prevention is worth a pound of cure." Iron, like man, wears away with age and should be placed on the retired list, the same as our judges and naval officers.

In an experience of over thirty years with steam boilers, I have seen many cases where the slight blow of a hammer has punched a hole through the shell plate, which was found not to exceed one-sixteenth of an inch in thickness, when on the preceding day it had carried ninety pounds steam pressure to the square inch. Many such cases might be cited, tending to show how dangerous it is to rely upon inspection in one sense and how important it is to rely upon the qualified age of the boiler in the other. All intelligent engineers know that constant pressure of any kind produces an alteration in the granulations of steel or iron. That is to say, the molecules become in a measure disintegrated and eventually destroyed—an alteration which it is impossible to detect by any known test at present in use; such being the case beyond dispute, it is clear that however well cared for, at the end of ten (10) years a steam boiler must be considerably weaker than when first built, however well constructed.

It is also well known that by long use the metal of a steam boiler becomes weakened by corrosion, which acts unevenly and in different parts of the structure and this deterioration cannot be detected by the ordinary inspection, especially as relating to the elasticity of the metal. This partial disintegration of the fibers or crystals of the metal by the high steam pressures now generally carried, will, independently of other causes of weakness, cause after a lapse of time such reduction of its strength as to prevent an accurate determination of whether or not it is in a fit condition for use.

Therefore, it seems to me, that a law defining the number of years during which a steam boiler may be used, is absolutely necessary for the protection of the public, and especially in view of the fact of the recent Dry Dock, East Broadway and Battery Railway Company's boiler explosion.

W. BARNET LE VAN.

Milling Machine Feeds—Jumping at Conclusions.

Editor American Machinist:

Letters and articles regarding the idea of running milling cutters "the other way" seem to be in fashion; there is one reason why more work can be done by this method that I do not remember to have seen mentioned, and that is the power transmitted by the belt that drives the whole machine is applied in its most efficient form. What I mean by this is, that the feed belt (and most milling machines have a feed belt) has only the table to drive, or at most a very little more, and as 99 milling machines out of 100 have a feed belt with only strength and speed enough to drive a perpetual motion machine under a glass case, it stands to reason that more work could be done by the method in question.

But the principal reason why more work was produced by this method was this: The experiment happened to be tried on a machine that had a coarse worm gear feed, and as something must be done to keep lost motion out of the table, the man who was doing it happened to pick up a heavy weight and tie it on the end of a rope or something passing over a pulley, and every time the poor fellow who ran the milling machine turned the table back by hand, he stored up quite a little power in that weight, and as the worm was coarse all the weight power that was not needed for moving the table was transmitted back through the feed belt, and helped the main belt instead of drawing on it, as it would do as usually run. It was mighty strange under these circumstances that more work should have been produced by the machine, wasn't it? Then the man rigged up a scheme whereby the power to keep the table ahead of the cut by a belt from the spindle, same as the feed belt, and then found he couldn't get any more work than the old way, and the same thing was tried on a machine having a fine worm feed, so fine that the angle of the threads came within the "angle of friction" (as I believe you call it), and then they couldn't get as much as by the old way, with all the improvements left off. You see nobody seemed to have taken any thought of the poor fellow who had been breaking his back lifting that heavy weight all this time; in fact I didn't think of him myself, because you see I wasn't the one who was lifting the weight.

I have come to this conclusion: When the cutters begin to get dull there is less power wasted in friction running them "the other way" than "the old way." And that's all there is to it.

GREASER.

The Hollow Fire in Blacksmithing.

Editor American Machinist:

I have received from a foreman blacksmith a letter in which is the following: "Can you not give us some description of what is known in blacksmithing as a 'hollow fire'? I know it is used largely for heating large pieces of iron, but the shape of the fire and the method of using, I believe, would be of great interest to many blacksmiths. Probably there are some of your able correspondents that can give the desired information. It is desired to use

the ordinary smithing coal such as Blossburg or Cumberland."

In answer to this permit me to say that hollow fires are in common use where an even heat is required. The foundation is laid according to the kind of tuyere used. In common blacksmithing the fuel is coking bituminous coal, "sea coal" it used to be called; it is now in these regions known as "Cumberland" or "Blossburg," taking its name from the mines from which it is raised. With a bottom tuyere the well-wetted coal is solidly packed around the inlet, and the walls raised to whatever height may be required. It is then finished like a side blast. With a side blast, either from a dry or wet tuyere, the practice is sometimes to carry the fire out into the forge and let it get nearer the tuyere as it burns. To do this a round bar of iron, of suitable size and length, is led from the tuyere out into the forge and packed over and around with hard-tamped wet coal. When the iron is pulled out the hole it leaves serves as an air pipe; the walls of the hollow fire are banked around the end of this to the desired size and height. The kindling may then be put in and the interior filled with light pieces of loosely coked coal to the height of the walls, and this serves to pack the dome-shaped roof of the hollow fire upon, to a good thickness, which will stand repairing. A small opening is then made in front to gain entrance, and the kindling lighted if it has not been made of live coal. The fire is soon brought up by a moderate blast ready to receive the work, then the entrance may be picked away until it is large enough to take the work in. The fire is fed with coke previously prepared for it, although a skillful workman by adroit maneuvering will manage to keep his stock from running down.

B. F. SPALDING.

Upper Tuyeres—Burning Out Cupola Linings.

Editor American Machinist:

Mr. J. H. Whiting, in the AMERICAN MACHINIST, December 14, 1893, calls me up for my criticism on the question of "upper tuyeres" in the article I read on "center blast tuyeres" before the Western Foundrymen's Association, October 18, 1893, published in the AMERICAN MACHINIST, November 2, 1893. It is far from my intention to injure Mr. Whiting or any other cupola manufacturer. I simply stated my experience and that of others in regard to "upper tuyeres" burning out linings, and have nothing to retract from the statements there made.

I never have had the opportunity to work or see a Whiting cupola used, but my impression formed of it from indirect sources lead me to think I would not class it as a strictly "upper tuyere" cupola, and if Mr. Whiting will illustrate with "cuts" and a clear description of the exact construction of the tuyeres in his cupola, and also give logical reasons why the plan and principle of same are such as to obtain the results he claims, in opposition to those set forth in the article which he states condemns "upper tuyeres" as injurious to linings, I will cheerfully discuss with him any points of value in the matter of cupola construction or running of same he may bring up, as long as the controversy can interest and be of value to foundrymen in general.

A matter I would wish to have here corrected is Mr. Whiting's comparison of the amount of fuel I used. If he will closely read the article, he will see the 3,000 pounds of coke on the bed was that used previous to the use of the "center blast tuyere." After its adoption, we melted with 2,100 pounds of coke on the bed, 900 pounds less than he stated we used, and with the changes and bed our saving by the use of the "center blast" is about one-third of that when the old method was practiced.

As regards the inconvenience of the device in dropping, I would say it is not near that Mr. Whitney would wish to infer. Of course, any one can readily perceive it is not as convenient as we might wish it, but nevertheless, 20 minutes' labor of two men will easily perform the work it may involve, and if by same a firm could save from $1.00 up to $6.00 per day in fuel, I think it would make the cost of additional labor of secondary consideration.

In this connection it would be interesting to hear from others who have had experience in the use of upper tuyeres.

THOS. D. WEST.

Those Armor-piercing Projectiles at Chicago.

Editor American Machinist:

I notice in your issue of December 21st a reference by H. H. Hardinge to our armor-piercing projectile exhibit on the "brick" battleship "Illinois" at the World's Fair. Judging by it, I consider it nothing short of my duty to give to AMERICAN MACHINIST readers a little more light on this branch of modern ordnance. The particular projectiles in this exhibit were taken from a lot we had on hand which were the results of numerous penetration tests at our proving grounds. The plate was, as correctly stated, wrought-iron and 4 inches thick, but the projectiles were roughly 2¼ inches diameter (6 pounders) instead of 4 inches and 8 9/16 inches long instead of 10 inches, as stated. Brother Hardinge must have just come from the Midway, if he measured these by eye.

The shells had all successfully passed the very severe test which the United States Government require. This test is: A certain per cent. of the whole lot submitted must penetrate a 4-inch wrought-iron plate, and when recovered from the sand backing must not show more than ¼-inch upset in length, or any cracks or defects of any kind. But on the other hand, when fitted with a base fuse and loaded with service powder, and fired through a 2 inch oak plank, they must burst into many fragments, and these fragments must have a cone of dispersion of at least a certain angle. Thus the shell must be strong enough to penetrate nearly double its diameter of wrought-iron, and not show a blemish, and still be weak enough to break up into small fragments when burst.

Another limitation of the problem is the fact that the length and weight are fixed. It is plain to see by this that quality of material and uniformity of manufacture must be of a high order.

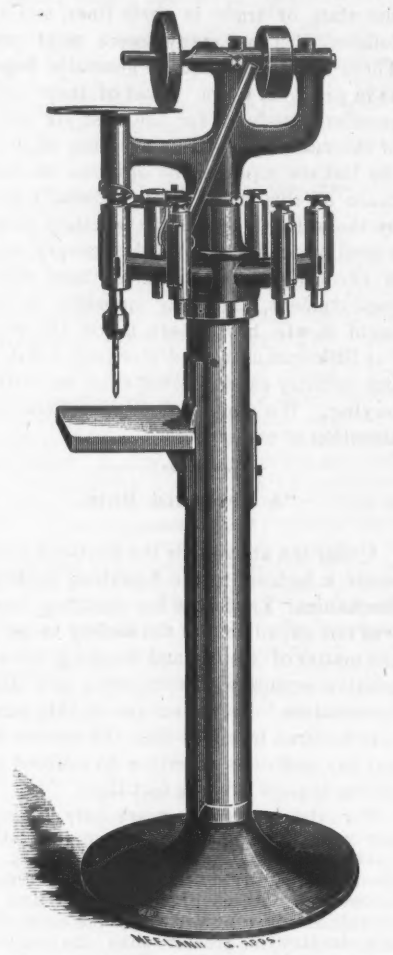
In testing, the Government officer selects 10 shells from the lot of 1,000 submitted, and every one of these 10 must pass either the penetration or the bursting test successfully, or the entire lot which they represent is rejected.

The shell that was cut in sections to better show the manufacture, evidently gave a wrong impression. A steel casting would never stand the test required. The question to the practical mechanic who looked at it was, how, if the thing was not cast, did they bore the large hole which forms the chamber through the small hole in the base, which is the hole for the fuse? This certainly is a hard question to one who does not know the operation. It is really done by electrically welding two steel cups together, one flat-bottomed—the base,—and one pointed—the head. This union of the two cups naturally forms the hollow projectile.

If Mr. Hardinge could have escaped the eagle eye of the marine on guard, and got within closer range, he would have seen the small burr on the inside which the weld left, and to show which, the shell was cut in sections.

The one that had successfully penetrated twice is considered quite a medal, as it speaks well for the hardening methods employed. Every shell has to be hardened in such a way that uniformity is guaranteed. They must be hard enough to resist a file from the point to where the body size commences, and gradually decrease in hardness from here to the base.

If the points of these projectiles were dull or flattened, as is stated, it must have been done by the countless fingers that "unlawfully" tested their sharpness. What these poor shells had to stand in the way of countless repetition would dull a diamond, however. I saw in the neighborhood of 500 people pass our exhibit, and I am prepared to take a double distilled oath that 490 of them asked the man next him "how he would like to get hit with one of them?" One collarless individual in



FRICTION TURRET DRILL PRESS.

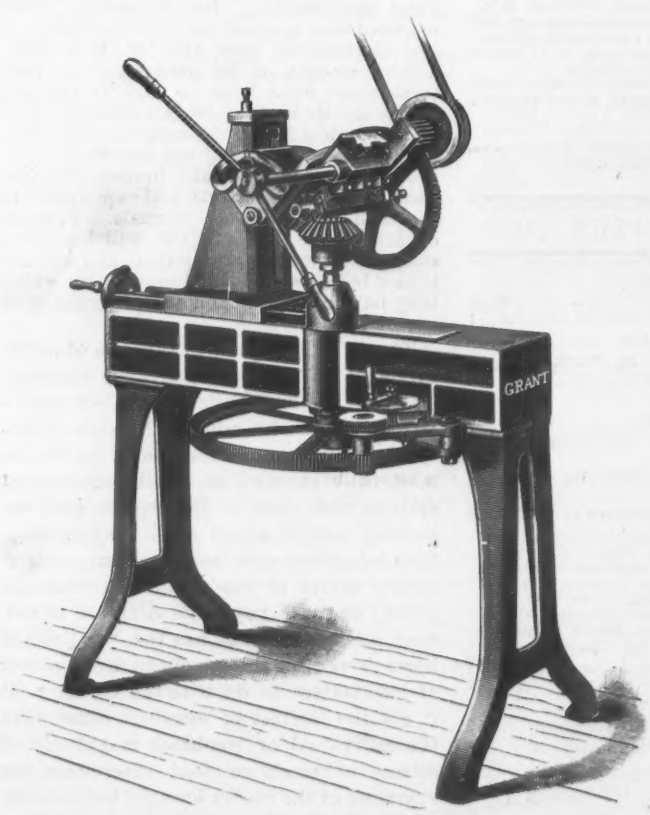
homespun, presumably from somewhere back of the Rockies, discredited the statement, as he understood it, that we had "hit the same hole twice."

Comparing the modern armor-piercing projectile, either large or small caliber, with the proverbial candle and the ¾-inch pine board is hardly fair.

H. P. MAXIM,
American Projectile Co.

Jobbing Gear-cutting Machine.

The accompanying illustration is of a machine designed especially for that class of gear cutting in which there are perhaps one,



JOBBING GEAR-CUTTING MACHINE.

or at most only a few gears of a kind to be cut at one setting of the machine, and where, consequently, the prime requisite is a simple, easily adjusted and quickly manipulated machine.

The blank to be cut is placed upon an arbor at the upper end of the index spindle, and the cutter is made to travel at any required angle to suit bevel or spur gears by adjustment of the slide upon the knee.

The index wheel is a spur gear equal in diameter to the full capacity of the machine (an important point), and the spacer is a simple crank with gearing, easily and quickly handled and provided with a graduated index for widening spaces and for fine dividing. By this index odd and unusual work is easily managed.

The spacer may also be very readily freed from the master wheel, and then the index spindle may be revolved rapidly enough to see that a blank is true upon it before cutting.

The spacer is locked firmly at each tooth and thus a fruitful source of "creeping" and errors in spacing is avoided.

There is an index for depthing the cutter in the work, and the quadrant is graduated for setting for bevel gears.

The capacity of the machine is to cut gears up to 24" diameter. It is made by George B. Grant, Lexington, Mass.

Those interested may get by writing to Edward H. Wahl, Secretary Franklin Institute, Philadelphia, Pa., full directions as to the steps necessary to be taken for having inventions, discoveries and meritorious work examined with a view to competing for premiums and medals offered through the society by different benevolent gentlemen.

Friction Driven Turret Drill Press.

We illustrated and described a short time ago a friction driven drill press made by the Stover Novelty Works, of Freeport, Ill., which drill press is so arranged that the driving power is proportioned to the size of drill being used, this resulting from the fact that the driving disk moves to or from the center of the driven disk to alter the speed, and also that the spindle thrust is taken by the friction disks instead of by collars, the pressure with which the two disks are forced into contact being therefore somewhat proportional to the size of drill in use, other things being equal. Another result of this arrangement is that when not in use the pressure is relieved to such extent that the spindle automatically stops. In the present machine the above features are retained and a turret as shown is added, which may have four, five or six spindles as may be desired, these being made to revolve only as they come into position by the revolution of the turret.

The capacity of the machine is to drill holes from the smallest to ⅛" diameter at the center of a 10" circle. The greatest height from platen to spindles is 32½"; diameter of column, 3¾"; diameter of spindle, ½"; size of table, 9"x11". Spindles are fitted for No. 1 Morse taper.

He Had Traveled.

"Now," said the intrepid explorer after he had shown the guileless native the inside workings of the brass watch and had noted his naive wonder at the mysteries of the mechanism, "I will let you have one of these for two tusks. Then you can be the envy of the whole tribe." The native gentleman yawned.

"I traded a second-hand war club for a bushel of those things when I was at the World's Fair last summer," said he, "and there was not a one of them that ran for more than a week. Got any chewin' about your clothes?"—*Indianapolis Journal.*

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Our Letters from Manufacturers.

In accordance with our usual custom, we publish in this, the first issue of the year, a number of letters from leading manufacturers in various machinery lines, setting forth the state of trade in their lines, and shall follow with as many more next week. These letters are not so generally hopeful as in previous years. Most of them tell of excellent business for the first six months of the year, followed by a falling off during the last six months, the opinions as to the cause of this being quite generally stated by the writers. Some of the letters refer to a gradual tendency towards recovery, which is encouraging. Of course there will be improvement, the only question is, how rapid it will be? There is, on the whole, but little manufactured stock on hand, and the country cannot always go on without buying. We commend these letters to the attention of our readers.

"A Neglected Duty."

Under the above title the *Railroad Gazette* reads a lecture to the American Society of Mechanical Engineers for deciding that it was not expedient for the society to go into the matter of testing and deciding upon the relative economy of compound and simple locomotives. In the course of this lecture it is declared in effect that the society does not pay sufficient attention to railroad matters as is shown by the fact that:

For the last three years only about 5½ per cent. of the papers or communications have related to strictly railroad work, although the individual horse-power of many locomotives is as great as 1,000, and the combined horse power of the locomotives of this country is greater than the combined horse power used for all other purposes. More than this, locomotive design and manufacture, the laying out of railroad shops and the construction of cars, cranes, signals and special mechanical appliances used on railroads, require the highest order of mechanical engineering talent. Note also the great variety of engineering laboratory and dynamometer work that has been published only in the technical papers, and has not appeared in the proceedings of the American Society of Mechanical Engineers.

It is not to be wondered at that railroad men have formed their own societies, and that the railroad clubs are to day doing a work that would otherwise have been done by the engineering societies had they given railroad mechanical engineering the attention and consideration which it deserves. In a comparison of this kind the American Society of Civil Engineers stands out with great prominence. Its proceedings have recorded very much of the important railroad civil engineering work that has been done. Thirty per cent. of its papers for the past three years have been on strictly railroad subjects. So long as the American Society of Mechanical Engineers maintains its present apathy toward railroad mechanical engineering, that important branch will continue to be best set forth and expounded in the technical railroad journals. Perhaps eventually the railroad clubs will become a strong engineering association; at least this is now indicated by the present plan which they have of joint action and interchange of proceedings.

The A. S. M. E. had at the time of publication of its last catalogue 1,555 members. Of these 49—or a little over 3 per cent.—are connected with railroads in some capacity, the Pennsylvania road being by far the most fully represented, while other great systems and most of the smaller ones are entirely unrepresented in the membership. This being the case, how does our contemporary arrive at the conclusion that the society ought to pay more attention to railroad matters? What has the "individual horse power" or the combined horse power of locomotives to do with the matter? Is it not the interest of members rather than the individual or combined magnitude of classes of machines that determines the character of the matter brought before technical and scientific societies?

During the thirteen years covered by the published volumes of the A. S. M. E., 431 formal professional papers were presented at its meetings; of these 15, or about 3½ per cent. relate directly to railroad matters, and of these 15 papers not one-third were contributed by members connected with railroads. We do not see how an indictment can be brought against a society on the basis of what is or what is not presented at its meetings. For what is presented at such meetings must depend upon the members themselves, and is generally supposed to represent what they are interested in, except so far as the representative character is modified by lack of opportunity by the members to prepare and present papers; a lack which we are quite sure does not come from any obstacle presented by the A. S. M. E., or its officers. It is the custom of the secretary of that society to invite members to present papers pertaining to work in which they are especially interested. Railroad men, as well as others, have received these invitations, and our figures show to what extent they have responded. We do not in the least blame them for not responding more fully; we think they have a perfect right to follow their own judgment and inclination in the matter, but we also think that no one assuming to speak especially for them has any ground whatever for blaming other members not railroad men, or the society itself, for not providing a larger fund of information on railroad subjects.

The fact is, however, that a very large proportion of the data and information presented by other members in papers and in discussion can be and actually is used in connection with railroad work, though since it pertains just as much to other branches of mechanical engineering, it is not and should not be classed as railroad matter.

And so far as comparisons with the American Society of Civil Engineers go, it is very easy to account for its greater proportion of matter relating to railroad work when we consider what a very large proportion of the work of civil engineering in this country consists in that which is connected with the construction and maintenance of railroads—probably more than 30 per cent. And it is in every way better that this matter should be presented and discussed in a separate society whose members are especially interested in it.

As to the decision of "those who guide the American Society of Mechanical Engineers" not to appoint a committee to test and decide relative merits of simple and compound locomotives, we think the decision is a wise one.

Any member of the society who has had experience in either building or operating compound locomotives would, we all know, be warmly welcomed at any meeting of the society with a paper giving information relating to that experience. This, by discussion and comparison with other similar matter, would go to form a mass of information from which railroad men could get far more of practical value than they could ever hope to get from the report of a committee especially detailed to make a comparative test, which, unless it involved enormous expense, would be incomplete and inconclusive for the purposes of a railroad official trying to decide whether for his particular road and service he should buy simple or compound locomotives.

Let, for instance, the master mechanic of the Central Railroad of New Jersey present a paper giving in detail the reasons why the Royal Blue trains were formerly pulled to and from New York by four-cylinder compounds, and why the latest machines designed and built for that service came from the same builders but are simple locomotives.

Then let the designer of the compounds in question present a paper explaining why the compounds were best for that service—his not being a member of the society would make no difference—both these papers you may be sure would be welcome, and would undoubtedly be discussed by men thoroughly competent to dissect them; they would make "mighty interesting reading," and, with the discussion, would contribute to the solution of the problem of relative economy, although they would by no means settle this question any more than a formal test by a committee would settle it.

And supposing such a test to be made by and at the expense of the society; then how could it refuse to test and certify to the relative merits of different makes of steel, twist drills, etc, that are also important questions for mechanical engineers? The fact is that the A. S. M. E. was not organized to maintain a free bureau of tests, but is simply a convenient channel for exchange of experience and thought by members upon matters of interest to them. If the society could test and decide all such matters as the relative merits of different machines and others things used in mechanical engineering, and should choose to do so, it would for obvious reasons not be to the interest of engineers to support it.

The Effect of Water in Steam.

An editorial writer in *The Engineering Record* takes exceptions to the conclusions of Professor Carpenter's paper read at the recent meeting of the American Society of Mechanical Engineers on "Experimental Determination of the Effect of Water in Steam on the Economy of the Steam Engine," which was briefly summarized in our issue of December 14th. Our contemporary says:

As to the tests under consideration, they were made upon an engine which developed, as a maximum, only 8 7 indicated horse-power, the dimensions of the cylinder being 6 inches diameter and 8 inches stroke. . . .

These tests may be reliable as indicating the effect produced on a particular engine which was tried, but they certainly cannot be held as a fair indication of the effect of moisture in steam in general. We have taken the trouble to analyze the diagrams which are submitted with the paper, and we find that the steam shown at the cut-off is only 60 per cent. of the actual consumption while at the release it rises to some 85 per cent. of the quantity used, taking the case where the moisture was 0 9 per cent. There is evidence, therefore, in these diagrams of an excessive amount of re evaporation, or some other action having the same effect, upon the expansion line. The engine was already suffering apparently from condensation, a condition which is generally found in engines of small size. The addition of more water to the steam already overloaded in the cylinder could not be expected to produce the effect that it would in a case where the action of the steam conformed more closely to the laws of economical engines which occurs in cylinders of large size.

These results do not conform to the general belief among engineers that wet steam is a disadvantage, and the tests reported in reality prove nothing.

As we understand the matter Professor Carpenter's paper was important not in the way of presenting new ideas on the subject but in confirming, so far as possible in a test of one engine, opinions very generally entertained by engineers. Twenty years ago Mr. Charles T. Porter, writing on this subject, said:

But if the condensation of dry entering steam goes on increasing so long as the cylinder can, during the expansion and return stroke, re-evaporate the water formed, as it certainly must do, it does not appear how water contained in the steam and diffused as a cloud through it can increase this action materially; and so it would seem that the loss occasioned thereby is mostly that of the heat carried away from the boiler by the useless water.

This we believe has been, practically, the opinion of engineers for some years, but actual tests such as Professor Carpenter's paper referred to are important as tending to dispel doubt.

So far as the particular engine used for the purpose of making the tests "suffering apparently from condensation," that is exactly the case with any engine, large or small, using dry (anhydrous) steam, or even steam considerably superheated, and we cannot see that the size of the cylinder had very much to do with the question at issue, an opinion which seems to be borne out by the statement of Professor Jacobus that both he and Professor Denton had made similar tests on (presumably) larger engines with results substantially the same as those stated by Professor Carpenter.

As to the difference between steam at cut-off and release, this we should say does not in any way discredit the conclusions ar-

rived at and stated in the paper. There is always in engines operated under similar conditions a discrepancy in this respect (valves and piston being tight) and whether this is a little greater or less seems to be rather immaterial.

We quite agree with our contemporary that the tests "prove nothing." A hundred tests on as many different engines could hardly be said to *prove* anything. But as testimony in such cases is, of necessity, usually considered we should say that this was very fairly conclusive, and confirmatory of the opinion of Mr. Porter as intimated in the quotation above given.

We do not understand that any engineer ever claimed that the use of wet steam was not disadvantageous, and Professor Carpenter was by no means advocating the use of wet steam.

Monthly Meeting of Engineers.

In our issue of last week we gave, by mistake, the wrong date for the first monthly meeting of mechanical engineers for informal discussion of engineering topics. The meeting will be on Wednesday evening, January 10th, at the rooms of the society, No. 12 West 31st Street.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(1) M. R, Huntingdon, Pa., writes: Please give me a rule for computing the horse-power of an engine when tested with a brake. I have looked over your back numbers, but cannot find it. *A.*—In answer to Question 155 in our issue of April 14, 1892, you will find this subject thoroughly explained and illustrated.

(2) T., ——, asks: If I have a square thread, six, eight, or any number of threads to the inch, how am I to know the width of tool to use? *A.*—Usually square threads are made with thread and space about equal, so that a tool for six threads per inch will be $\frac{1}{12}''$ wide, eight per inch, $\frac{1}{16}''$ wide, etc. Of course such allowance may be made for fit as circumstances call for.

(3) S. F. B., ——, asks: Will you please tell me how to straighten a stay bolt tap after being hardened? *A.*—Scour it clean so that you can "watch the color run" upon it. Then bring it nearly or quite up to the heat to which it was brought in drawing the temper originally. While at this heat straighten it, which can then be done without much trouble.

(4) M. V. M., ——, writes: I am running a new Pond lathe with taper spindle bearings. I wish to know how to take up wear in boxes, *i. e.*, which way to turn the collars on the back and front of the boxes? *A.*—In this lathe the spindle bearings are cylindrical, but the boxes are tapered outside, and are closed upon the spindle by slacking the threaded collar at the large end, and tightening the opposite one. The threads are right-hand.

(5) E. A. C., ——, asks: Will you please inform me of the best way of hardening pieces that have thin flanges on them to prevent cracking? *A.*—We know of no way of entirely avoiding trouble from this cause. It is usually best to avoid having heavy sections and thin flanges on the same piece, but when this is impossible, then dip them if possible, so that the heavier parts are cooled and fully shrunk while the thin parts are still hot and can yield, then dip the thin portion.

(6) H. W., ——, writes: Please give me the best method of cutting a spiral milling cutter in a duplex milling machine. I have a way to revolve the work, but not a way to run the cutter at an angle to suit the spiral, as we cannot swivel the table? *A.*—We know of no way of doing this work unless in some way the feed motion can be made to take place at the proper angle to the cutter arbor. It may be possible to arrange the machine in some way to accomplish this, but we are unable to suggest a method, especially as we are unacquainted with the construction of the machine.

(7) G. W. K., Altoona, Pa., writes: Would you kindly inform me what is a right-hand diamond point lathe tool, and why it is called a right hand tool? There is a dispute among the foremen in regard to this. *A.*—A right hand diamond point tool is one that is fed to the left when in the lathe. We do not know the origin of the designations of right and left-hand tools, but think that all the more commonly used tools were originally called right-hand to distinguish them from the less frequently used ones, the latter being called left hand for want of a better name perhaps.

(8) G. W. B., ——, writes: I have been making a fencing foil but am unable to harden and temper it satisfactorily, *i. e.*, without much springing. Please inform me how to do it? *A.*—You must first have a fire long enough to heat the entire foil at once and in order to secure this it will probably be necessary to construct some sort of muffle out of fire brick or sheet iron. Be sure to secure a uniform heat throughout the length of the foil and then dip it vertically into the water. If then upon examination it is found to be sprung, straighten it while drawing the temper and when at nearly or quite the maximum drawing heat.

(9) "A Subscriber," Boston, Mass., asks: What liquid may be used to advantage on turret tools when performing the operations of drilling, reaming, milling and screw cutting on soft steel forgings, in fact all operations usually performed with such machinery? Is there any one liquid or mixture that may be used for all these operations on steel that will enable the machine to turn out the maximum quantity of good work? *A.*—There is such a liquid, and that is lard oil. Nothing has been found that equals this, and if a centrifugal extractor be used for recovering the oil from the chip, it is usually, all things considered, much the most economical, especially where the grade of work done requires that the tools be kept in prime condition at all times.

(10) F. X. D., Quebec, Canada, writes: I am called upon to repair a steamboat engine, the trouble is that of a poor vacuum; there is no leak about the connections, the circulating pump and all passages are large enough. The outlet for the water of condensation from the condenser is about 6 feet lower than the air-pump inlet. I think the trouble is there, due to the head of the water, and the vacuum is poor in proportion to that head of water remaining between the condenser and the air pump. Please give your advice? *A.*—The unsatisfactory vacuum is due to the head of water remaining between the condenser and the air-pump; this will be evident from the fact that the pressure which supports this head of water must be the pressure in the condenser, and this, of course, will reduce the vacuum. The condenser and air-pump should be brought near to a level or better still, the air-pump inlet should be a little below the outlet of the condenser.

(11) M. R., Cleveland, O., asks: What is a good rule for calculating the size and number of balls to use in ball bearings, taking into account the speed and pressure on the bearing? *A.*—The few experiments made with ball bearings, and the data obtainable relating to them, are not sufficient to give any rules for designing them. The custom is to compute the size of an ordinary bearing for given conditions, and then put in as many balls as the bearing will admit. The size of balls vary from $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter according to the diameter of the journal; the selection of the proper size of balls depends much on the judgment of the designer; there should be as many points of contact as possible between the journal and bearing, and therefore balls of small diameter are generally selected. 2 What is the limit of usefulness in speed and pressure beyond which ball bearings should not be used? *A.*—So far experience has shown no other limit than that which limits ordinary bearings. 3. How would you modify the rules for roller bearings? *A.*—We should not make any modification, but proceed as stated above.

(12) L., Chatham, Ont., asks: Please give a rule for cutting fractional threads on the lathe? *A.*—In the case of fractional threads gears can be selected for them by the use of the ordinary rules for whole numbers, if we first reduce the number of threads to be cut and the number on the lead-screw to the same terms. For instance, suppose we have to cut a screw with $4\frac{1}{2}$ threads per inch and our lead-screw is 3 threads per inch, $4\frac{1}{2} = \frac{9}{2}$ and $3 = \frac{6}{2}$. We now have two common fractions having the same denominator (2), and their numerators (9 and 6) are in the same ratio to each other as $4\frac{1}{2}$ and 3, the number of threads per inch of screw to be cut and lead screw, respectively. Now the gears called for will be in the same ratio (9 to 6), and multiplying both these numbers by the same number will give the required gears. Multiplying by 6, we have 54 and 36 for the gears; multiplying by 7 we have 63 and 42, etc. A graphic method by W. H. Croker will be found in our issue of November 9, 1893, and an elaborate method of calculation especially designed for the nearest approximation in the case of fractions with large denominators, by Geo. B. Grant, in issue of April 9, 1891.

(13) A. F., Philadelphia, Pa., writes: Kindly inform me as to what determines the size of a boiler? *A.*—The size of boiler is determined by the amount of water which is to be evaporated in a given time. After this has been established the amount of coal to be burnt can be determined and from this the grate and heating surface are computed as explained in answer to 246 in our issue of June 13, 1889; and also in an article relating to designing small upright boilers in our issue of March 27, 1890. 2. What factor of safety is used? *A.*—A so called factor of safety of 6 is generally used, that is to say, the stress in the plates due to the steam pressure is not allowed to exceed $\frac{1}{6}$ of the ultimate tensile strength of the plate. Since the riveted joints are considerably weaker than the solid plate, the real factor of safety is less, and in some cases much less than 6. 3. To what pressure are boilers tested above their working pressure? *A.*—The test pressure is usually equal to $1\frac{1}{2}$ times the highest working pressure above the atmospheric pressure. 4. There is an idea among my acquaintances that a pound of water pressure equals a certain number of pounds of steam pressure. I hold that a pound of pressure is a pound whether steam or water is used. We depend on your answer for the settlement of these contentions. *A.*—You are right, there is no difference between the intensity of steam pressure and water pressure.

(14) H. H. G., Southington, Conn., asks: Is the angle of the spiral in all threads the same? For example, 30 threads have a pitch of 5°; have all other threads the same angle? If not, then what is the angle of 16, 18, 24 and 32 threads per inch? *A.*—The angle of the spiral depends upon the relation between pitch and diameter of screw. It is not correct to say that 30 threads per inch gives 5° angle of spiral, because it will give this angle on only one size of screw, and the angle will be less on all screws of the same pitch larger in diameter, and greater on those smaller in diameter. The rule for computing the angle which the thread forms with a line drawn at right angles to the center line of the screw, or, in other words, the angle to which a thread tool must be inclined in order to have equal clearance on both sides is: Cotangent of angle $= \frac{\text{Circumference of screw.}}{\text{Pitch}}$. Which means that if we find the circumference of a screw at top of threads and divide this by the distance between two threads, the result will be the cotangent of the angle, and having this cotangent a table of tangents, cotangents, etc., will indicate the corresponding angle. Taking, for instance, 16 threads per inch, the U. S. standard bolt of this pitch is $\frac{5}{8}''$ or .375″ diameter; its circumference is 1.178″, and this divided by $\frac{1}{16}''$ or .0625″, according to the rule, gives 18.848, which is the cotangent of the required angle, and a table of cotangents shows this to be practically 3° 2′. Taking the case of a 1″ standard bolt, this has 8 threads per inch, and the angle is in this case 2° 17′.

(15) G. G., Rankin, Pa., writes: I have been reading books and papers treating on scientific subjects for a good many years, but there are some things that I have never been able to find out. 1. Can an engine put any more power into a fly wheel than its own power? *A.*—No. 2. If not, how can the force in the fly-wheel increase as the square of the velocity when the same force in the engine increases as the velocity only? *A.*—The force which produces motion in a steam engine is the steam pressure, and when the engine is running at a uniform rate of speed, this force, or mean effective pressure, does not increase. When this pressure is greater than is necessary for the load, acceleration will take place, and work or *energy*, not *force*, will be stored up in the fly wheel; the same takes place when the engine is started. The stored-up work in the fly-wheel is computed by the following formula: $\frac{1}{2}\, m\, v^2$, in which m denotes the mass which is equal to the weight of the fly-wheel (generally the weight of the rim) divided by 32.2; and v, the velocity in feet per second of the fly-wheel rim at the radius of inertia. If this radius is 7 feet 6 inches, the weight of the fly-wheel rim, 8,000 pounds, and the engine is running at the rate of 65 revolutions per minute, then the velocity of the rim will be 51 feet per second, and the stored-up energy will be,

$$\tfrac{1}{2} \times \frac{8{,}000}{32.2} \times 51^2 = 315{,}020 \text{ foot-pounds.}$$

If the engine has attained this velocity in $1\frac{1}{2}$ minutes after starting from rest, then the horse power expended in merely accelerating the fly-wheel will be,

$$\frac{315\,020}{33{,}000 \times 1.5} = 6.36.$$

You have evidently got the terms force and work mixed up. In reading scientific works be careful to get the correct meaning of the words. 3. If action and reaction are always equal, how is it that by an expenditure of $1\frac{1}{2}$ pounds in an air pump of a condensing engine we gain 13 pounds of work? This looks to be the nearest approach to perpetual motion that I have seen. Is it not absurd to get something for nothing? *A.*—You are right in stating that it is absurd to get something for nothing; you are evidently again mixed up in something you have read. You do not gain 13 pounds of *work*, but you may obtain an unbalanced atmospheric pressure of 13 pounds per square inch corresponding to the degree of vacuum produced by the air pump. The air-pump reduces the back pressure on the main piston, and therefore the mean effective steam pressure can do more useful work. Without an air-pump, with other conditions unchanged, the engine will perform the same total work, but less useful work.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gears, Lex'n, Mass., & Phila., Pa. See p. 12.

Forming Lathes Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith M. T. Co., Mill., Wis.

Turret Drills, 6 spindles. A. D. Quint, Hartford, Ct.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Pulley lathes, most efficient offered. The Lodge & Shipley Machine Tool Co., Cincinnati, O.

Air Compressors for every possible duty. Clayton Air Compressor Works, 43 Dey Street, N. Y.

Steam Pressure Regulators, Reducing Valves, Safety Checks. Foster Engineer'g Co., Newark, N. J.

The American Packing Ring fits your cylinders perfectly. J. H. Dunbar, Youngstown, O.

Upright Drills, stationary head, W. & L., with or without B. G. J. E. Snyder, Worcester, Mass.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves, T. Kieley, 11 W. 13th St., N.Y. Send for des'n.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

"Pumping Machinery." New book, 450 pp. 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton Avenue, Philadelphia, Pa.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc; machinery name plates in brass and aluminum.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

The "Buckeye" Valve Gear.

BY ALBERT K. MANSFIELD, SALEM, O.

(*Concluded from last week.*)

The very rapid increase in the use of compound engines makes it desirable, in discussing any valve gear, to explain its manner of application to such engines. In tandem compounds of Buckeye construction, motion is imparted to the valves of the out-board cylinder by a very simple device, illustrated by Fig. 12, page 10.

The main valve of the first cylinder has a hollow stem on its outer end, which, projecting through the cylinder, is clamped to the hollow stem of the main valve of the second cylinder; the clamp connecting these stems is made in two parts, bolted together in such way as to produce universal adjustment.

One part of this double clamp carries a bearing in which reciprocates a shaft, carrying at each end an adjustable arm; each

arm is attached at its outer end to the cut-off valve stem of the cylinder adjacent to it. In this way one set of cut-off valves is made a means of operating the other set without the use of complicated valve mechanism; and stuffing boxes surrounding all stems are easily accessible.

In Fig. 13 is shown the double clamp arrangement of Fig. 12, with the addition of another device called an "assistant valve-mover." This consists of a small steam cylinder and piston taking hold of the valve gear to assist the eccentric in the movement of the valves. In compound engines of tandem construction and of large power the inertia of starting the valves and valve gear at the beginning of each stroke is a considerable quantity, and imposes a severe duty on the eccentric. This is the case whatever the kind of valves may be which are used in the engine.

The theory of the action of this cylinder may be illustrated as follows: Let *a b c d e* (Fig. 14) represent the well-known diagram of inertia of reciprocating parts (valves and valve gear), and let the rectangle *b d f g* represent the diagram of friction of valves and gear on the assumption that this friction is constant, which it probably is not, but may be nearly enough for the present purpose.

A combination of these diagrams leads to a complete diagram *a c e f g*.

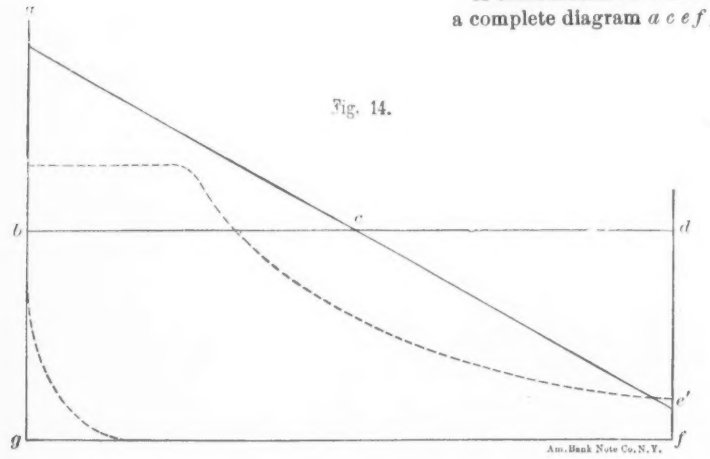


Fig. 14.

Now an indicator card may be drawn, as shown by the dotted lines, which approximates to this diagram, and the assistant cylinder is designed to so use the steam as to produce approximately this card. An actual card from such a cylinder is shown in Fig. 15. The cut-off is arranged to be constant and at about one-quarter stroke. The construction of valves and ports of this cylinder is shown by Fig. 16. It will be seen in Fig. 15 that the back pressure line is such that the resultant pressure at and near the end of the stroke is a back pressure; this is thought to be best in the case of so high speed an engine as that from which the cards were taken. For the maximum inertia of the parts in such an engine is so much greater than the retarding friction that (referring to Fig. 14) the line *a e* would run below the line *f g* at point *e*, making a back pressure at this point desirable. In slower running engines a slight change in adjustment does away with this back pressure.

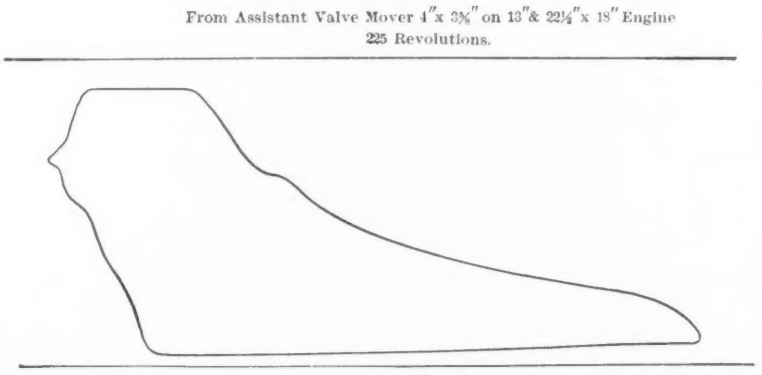


Fig. 15.

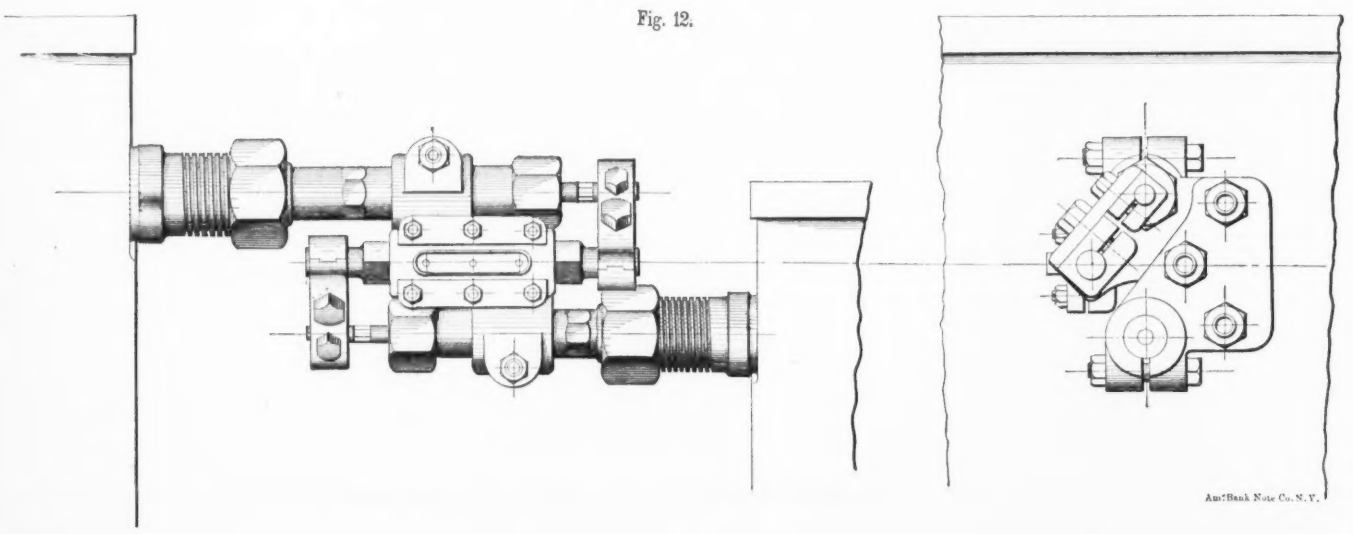


Fig. 12.

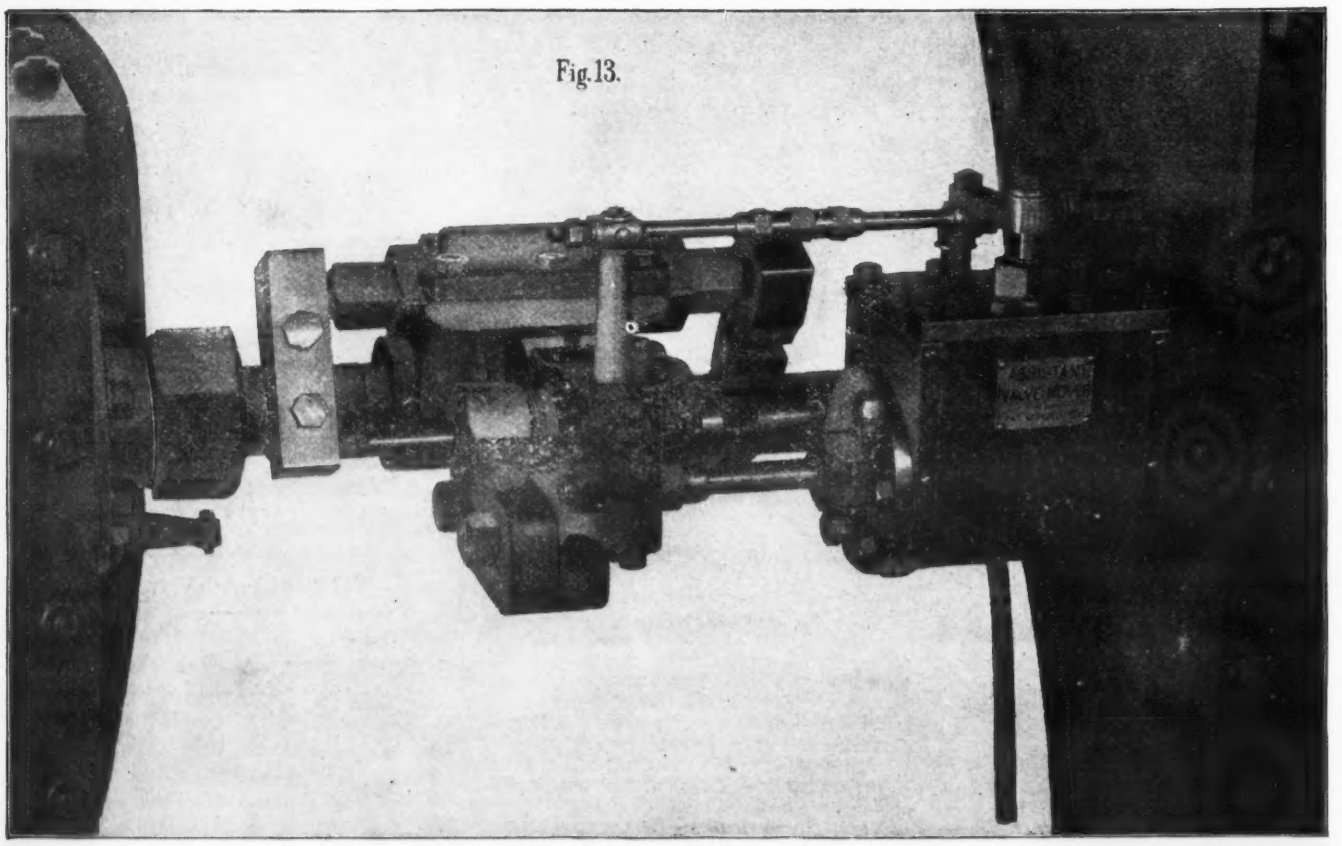


Fig. 13.

THE BUCKEYE VALVE GEAR.

It may be useful to note the fact that the uniform movement of both valves on their seats can be produced by a certain arrangement of their eccentrics without employing the compound rocker arm. In Fig. 17 let *b o* represent the eccentricity of a main or fixed eccentric operating the main valve, and let *e b* represent the eccentricity of a governing eccentric operating the cut-off valve and so arranged that it is rotatively adjustable about the point *b* by means of the governor. If connections to the valves be made directly from the points *e* and *b* then equivalent movements of the valves will be produced to those made by means of the rocker arms and eccentrics of Fig. 1.

No analytical proof of this need be made here. An examination of the figures will be sufficient for most students.

Suppose the point *e* to be adjustably moved to other positions as e_1, e_2, then the lines e_1 *o*, and e_2 *o* represent the half movements of the cut-off valve relative to any stationary point, as the main valve seat. It will be seen, therefore, that the actual movement of the cut-off valve in space is variable, while the angular advance of the cut off valve movement, measured from the center *o* of the shaft, varies at the same time.

Careful vs. Careless Engineers.

BY W. S. WAKEMAN.

On several occasions my attention has been directed to the different ways that engineers have or adopt for the care of the machines in their charge, and the vastly different results obtained, as the direct consequence of their ways of running steam plants. With some it seems to be a foregone conclusion that while an engine may be bright and clean when new, and also finely finished before being put into service, still it must of necessity become covered with burnt oil, dust and dirt after a few weeks' run, and that it is impossible to prevent the smoothly finished parts from being disfigured by blows with steel hammers, cold chisel marks, and scratches of various kinds.

Other engineers are of the opinion that an engine may be kept fairly clean, under reasonable conditions, and that the disfiguration mentioned above is unnecessary. Both of these classes proceed to put their theories into practice, and the results are apparent to the most casual observer. For illustration I cite the following circumstances: A certain engineer wished to disconnect the piston-rod of the 200 horse-power Corliss engine in his charge, from the crosshead, into which it was screwed in the usual manner, and fastened with a jam-nut. This rod was about three inches in diameter, and as it had not been removed in several years, it did not start easily. He took a pair of ordinary pipe tongs, and put them on to the rod just back of the jam-nut and proceeded to manipulate them in the same manner as when unscrewing a piece of pipe. The rod being smooth and round afforded no hold for the tongs until they had slipped around about an inch, plowing their way into the metal, until a firm hold was secured, when by means of force applied to the handle of the tongs, the rod was removed, but almost any reader can imagine the result, so far as the appearance of the rod is concerned. This man thought that such disfigurations were a part of the business, but another engineer thought differently, for when he wished to remove his piston-rod, he secured a piece of well-seasoned hard wood, about 6" long and 5" square. He took it to the band sawyer and requested him to set it on end and split it through the middle. Taking these two pieces he put them together again in their original position, except that he had a piece of pasteboard, the same thickness as the saw kerf, between them. Setting them on end as before, he proceeded to describe a circle the same diameter as his piston-rod upon their ends, one-half of it on each half of the block, and when the band sawyer had sawed out this circle, he had a block which could be clamped upon his piston-rod, thus presenting a square block on which he could use a 5" wrench with a long handle which he already had for use elsewhere. (It would be better to describe the circle before splitting the block.) This block was clamped to the rod as follows: He took four pieces of iron one inch wide, ⅝" thick and 6½" long,

and bored $\frac{1}{2}''$ hole in each end of them. These holes were $5\frac{1}{2}''$ apart from center to center, and when he put two bolts $\frac{7}{16}''$ in diameter, and $6\frac{1}{2}''$ long through each pair of the irons, he had two first-class dogs or clamps to hold the split block on to the piston-rod. By this means the rod was unscrewed without scratch or bruise, and the device was kept for future use. If the block inclines to slip, a piece of emery cloth put between rod and block will prevent it.

Some engineers run the jam-nut back to the end of the threads, and then use a wrench on it, but this plan is apt to bruise the thread in the nut, and cause it to work hard in use afterward.

If the engine has been in use for several years, the crank-pin key, or the wrist-pin key may be driven down so that the lower part of it hits some part of the frame. The careless engineer simply takes out the key and cuts off the small end of it, which causes it to clear the obstruction, but leaves it too short to look well. The careful engineer puts a piece of blocking behind one of the half-boxes, and thus raises the key into its proper place.

It is a little more trouble to keep a soft copper hammer to drive keys with, than it is to use a steel one, but the results are much more satisfactory to any engineer that cares to have his machinery look well. Well fitting socket wrenches are much better for use on the bolts which hold the bonnets in place, and on the nuts which secure the cylinder heads, than monkey-wrenches are, as the former hold on six corners while the latter take hold of but two, and so these corners are soon rounded off.

I have known an engineer in charge of a finely finished Corliss engine, fitted with nickel-plated sight-feed oil cups, to take a cold chisel (and not a very sharp one either) and cut into the top of the head of the little valve stem which regulates the feed, in order that he might see from a distance the position of the valve, when a glance at the drops of oil as they descended, would have been a much more satisfactory way to determine the amount of oil fed.

For parts that need permanent marks upon them for any cause, it is a good idea to use a fine scribe, and then to locate the marks where they will not be so prominent, and for temporary marks a lead pencil answers a very good purpose.

Of all the minor abuses to which I have seen engines subjected, I think that the practice of using a Stilson wrench on the nuts and other finished parts is the worst, and it is my candid opinion that any man that is so thoroughly dead to all sense of propriety as to do this, and be satisfied with the consequences, is not only an improper person to be in charge of expensive machinery, but I doubt very much his ability to become a competent engineer, for this term embraces a variety of qualifications.

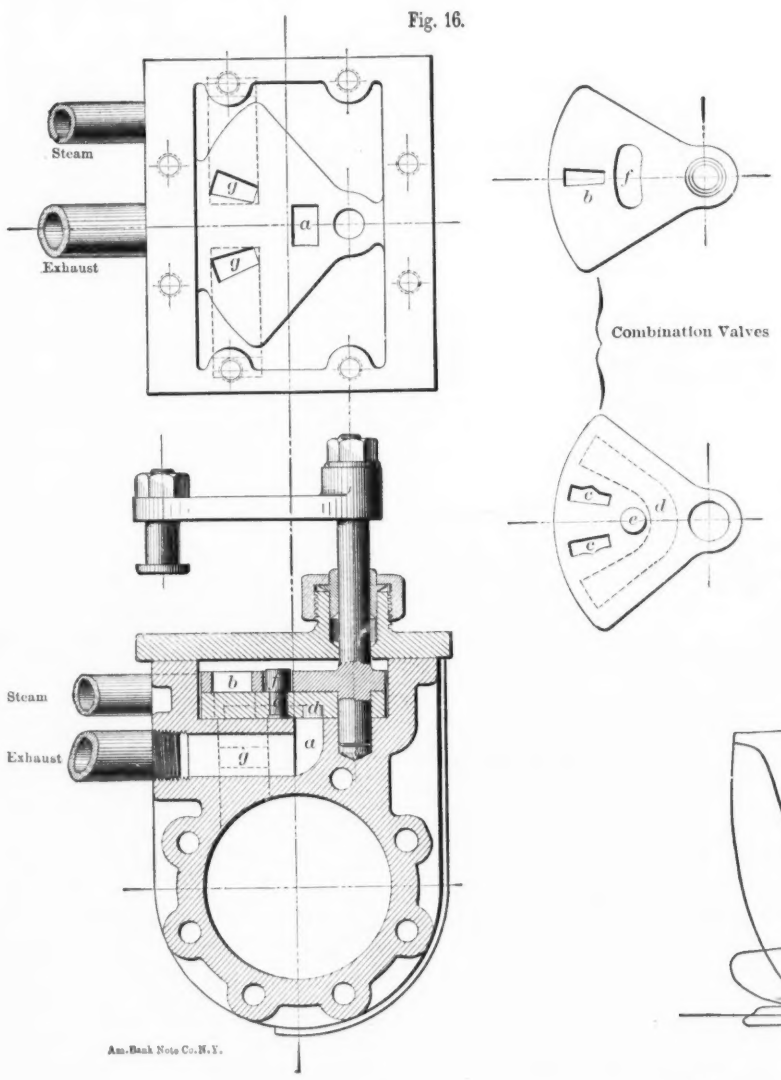
If oil which is dropped on the steam-chest cover, cylinder heads or bonnets is allowed to stay there until it is burnt on, and the residue allowed to collect, the consequence is that the whole engine soon has a dirty and untidy appearance, but this is entirely unnecessary, for a few minutes' work each day, or a little more time spent in cleaning up twice a week will make a vast difference.

Where bright work on an engine is painted over in order to save the trouble of keeping it clean, it does not speak well for the thoroughness of the engineer in charge, but rather shows an inclination to sacrifice good appearances for the sake of having less work to do.

Men who are careless engineers tell us that it makes no difference about these minor and outside affairs, so long as more important matters, such as keeping the inside of the boilers clean, and the valves properly set, are attended to, but steam users and competent engineers are much inclined to think that what we can see about a plant is an index to what we cannot readily see, and these ideas will not be radically changed in the near future.

James Moore, a well-known inventor, died on Friday. He was born March 18, 1812, and came to Pittsburgh six years later with his father. Mr. Moore became a worker in wood, and stuck to his trade for thirty years. He always had a taste for working out new ideas, and when 10 years old made a paper rowboat large enough to carry himself, from which grew the paper shells used by scullers to-day.—*Pittsburgh Dispatch.*

Fig. 16.



THE BUCKEYE VALVE GEAR.

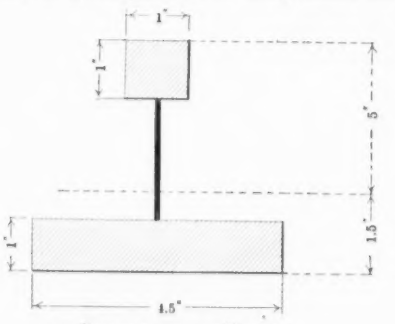
Strength of Beams.

BY E. D. MACKINTOSH.

On page 69 of the third edition of "Mechanics of Materials," by Prof. Mansfield Merriman, will be found an example of a cast-iron ⊥ beam of the following dimensions:

Span, 14 feet.
Depth, 18 inches.
Width of flange, 12 inches.
Thickness of stem, 1 inch.
Thickness of flange, $1\frac{1}{4}$ inches.

The author finds the movement of inertia to be 1,031 and the distances to the most remote fibers 12.63 and 5.37 inches. The ultimate strength per square inch he assumes at 90,000 pounds for compression and



STRENGTH OF BEAMS.

20,000 for tension. Adopting a factor of safety of 6 the professor finds the compression member good for a distributed load of 58,300 pounds and the tension member for 30,400. The exact figures however, by his formula, would be 58,307 and 30,475.

These results are not peculiar to his method but are also obtained by the commonly accepted formula $W = \frac{8\,S\,I}{l\,c}$ in which W denotes the load in pounds, l the distance in inches between the supports, c the distance in inches from the neutral axis to the fiber most remote from it, S the stress in pounds per square inch on the fiber most remote from the neutral axis, and I the moment of inertia of the section.

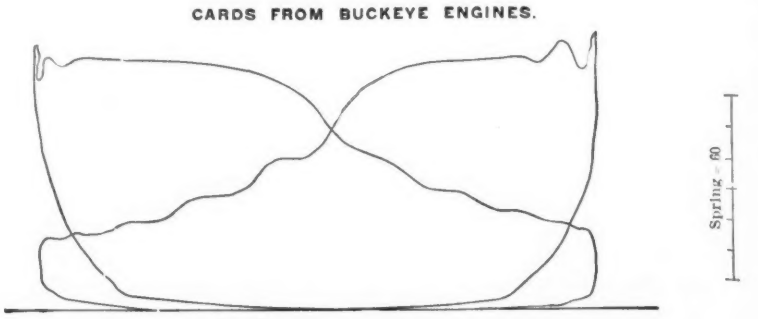
Applying this formula with 1 6 of the ultimate strength as the value of S,

$$W = \frac{8 \times 15000 \times 1031}{168 \times 12.63} = 58307$$

$$W = \frac{8 \times 3333\,33 \times 1031}{168 \times 5.37} = 30475.$$

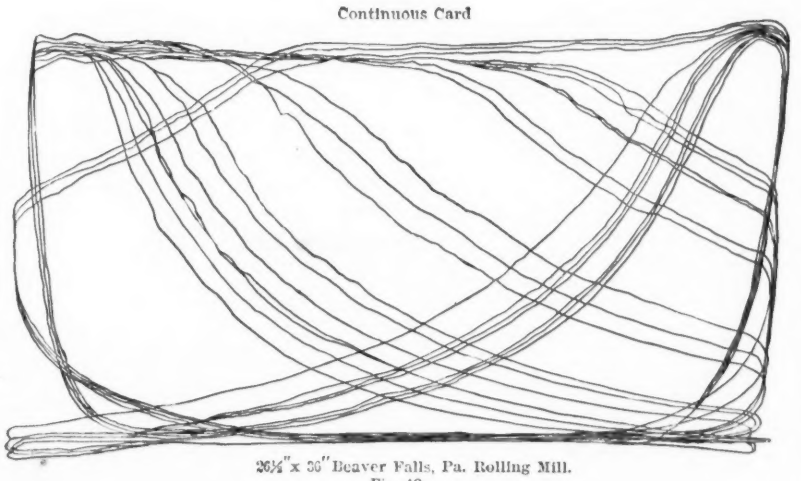
This example has been selected to show how the formula is applied by a good authority. It must be remarked that the moment of inertia of the whole section is usual in calculating the strength of both the compression and the tension members, also that the neutral axis is supposed to pass through the center of gravity.

CARDS FROM BUCKEYE ENGINES.

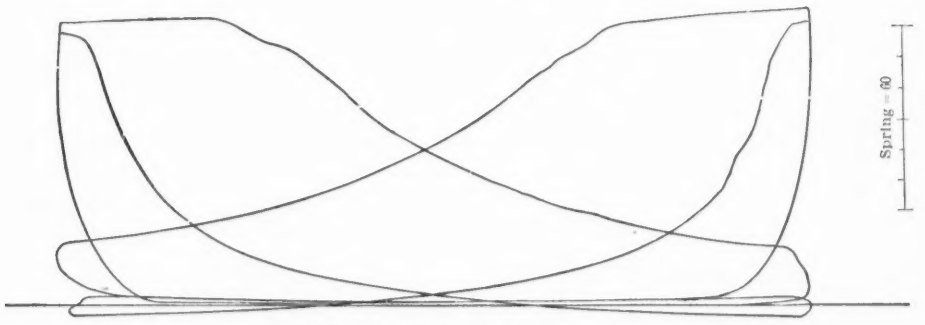


$6\frac{1}{2}''$ x $10''$ Engine — 338 Revolutions.
Fig. 17.

Continuous Card



$26\frac{1}{2}''$ x $36''$ Beaver Falls, Pa. Rolling Mill.
Fig. 19.



$18''$ x $30''$ Engine — 135 Revolutions.
Fig. 18.

Now I admit that such would be the position for a material having the same strength in compression as in tension but when the former is 4 5 times as great as the latter the position must change. If we were dealing with a material having strength in tension equal to that of steel, but in compression no greater than that of rubber, there can be no doubt that by far the larger part of the section would be devoted to withstanding compression, and the neutral axis would be far from the center of gravity. To prove this for cast-iron, with the values assumed above, let us substitute for the ⊥ section one as shown in the figure.

This may be considered as an open beam having no web, such, for instance, as a latticed girder.

Moment of inertia above an axis through the center of gravity 25.208. Distances from neutral axis to most remote fibers, 1.5 and 5 inches.

Applying the formula as in the previous example, with the same values for S.

$$W = \frac{8 \times 15000 \times 25.208}{168 \times 5} = 3601$$

$$W = \frac{8 \times 3333.33 \times 25\,208}{168 \times 1.5} = 2667$$

The compression flange is found to be good for a distributed load of 3,601 and the tension flange for only 2,667 pounds. In other words the compression flange is 1.35 times as strong as the tension flange.

That these figures are erroneous, and that the two flanges are of equal strength, can be proved as follows.

Assume for the moment that the beam is reduced by the removal of all but the extreme upper and lower layers of fibers, leaving only a single layer in each flange. These two will react against each other and the reactions will of course be equal. That they are also capable of equal resistance will

be evident when it is considered that there are 4 5 times as many fibers in the lower flange as in the upper, but that each upper fiber has the strength of 4.5 lower ones. If f represent the number of fibers in the compression flange, and S the strength of a single fiber in tension, the possible moment of each flange in relation to the other will be $4.5 f S$ 6.5.

This being the case the neutral axis must be located to give equal moments for the two flanges. The only position that will satisfy this condition is at the middle of the depth of beam, a position very remote from center of gravity; then the possible moment for each flange becomes $4.5\ f\ S \frac{6.5}{2}$.

If this reasoning be correct it is unnecessary to go further to prove that the neutral axis does not pass through the center of gravity when the strength of the material in tension is not equal to its strength in compression. We may continue, however, by adding layer after layer to the two flanges till they attain the proportions shown in the figure. To each pair of layers the same reasoning will apply and the neutral axis of the completed beam will be at the middle of its depth. Then let the moments of inertia of the two flanges be separately determined with relation to this axis. The values will be 7.6458 and 34.4062. Applying the formula separately to each flange,

$$W = \frac{8 \times 15000 \times 7.6458}{168 \times 3.25} = 1680$$

$$W = \frac{8 \times 3333.33 \times 34.4062}{168 \times 3.25} = 1680$$

These results show equal strength for both flanges which is in accordance with our previous reasoning.

To obtain the value of W for the entire beam the values of the two flanges must be added.

$1680 + 1680 = 3360$, a result materially different from the 3601 and 2667 obtained by the commonly accepted method.

Side Doors for Cars.

An interesting series of views, reproduced from photographs, are published in the December number of *Locomotive Engineering*, showing the rapidity with which the trains of the Illinois Central Railroad were loaded during the World's Fair. The trains were completely filled in 15 seconds after stopping at the platform. The cars were specially built with a view to facilitating this, and judging from the engravings, are practically the ordinary English car, with side doors—or, rather, openings, for there are no doors—the advantages of which in suburban trains are indisputable, whatever claim may be made for the superiority of the American car for long-distance traffic.—*Engineering* (London).

The fact is that cars constructed in this way (with side doors) can be loaded and unloaded much more quickly than those in which passengers must go in and out practically through a single door, and for suburban service this is undoubtedly an advantage. The cars of the Intramural road at Chicago also had side doors—one on each side of the car for each compartment containing two cross seats, the same as in English cars. The advantages of such cars for this service were readily seen, and there is little doubt that there would be corresponding advantage for such service as the elevated roads of New York, Brooklyn and Chicago, provided anything else were to be considered aside from the greatest possible carrying capacity of cars irrespective of comfort, decency, or safety, which are now entirely disregarded most of the time upon the elevated roads of New York.

But it is not impossible that we in this country will be as slow in recognizing this fact as Englishmen are in recognizing the fact that for other than local traffic our cars with end doors and no cross partitions are much superior.

We have received the 1893–94 catalogue of Case School of Applied Science, of Cleveland, O. It contains the usual list of students and information as to the school which is of interest.

Interchangeable Heels.

An English firm has recently been granted letters patent for an invention whereby the heels of boots and shoes can be easily detached or reversed. The invention consists of steel, or any similar material, shaped as a lift, with flange and groove, by the first of which it is fixed in any part of the height of the heel at the option of the maker, while the upper portion of the heel is so constructed as to slide into position so that it is indistinguishable from an ordinary heel; but to insure absolute security a fine screw is inserted from the inside. The advantages claimed for it are that when the top piece becomes slightly worn down the wearer can reverse it to the other boot, and after these have been well worn they can be replaced by a new set at a very small cost.—*Shoe and Leather Facts.*

MANUFACTURES.

The Wabash Iron Company, Terre Haute, Ind., which closed in September, throwing 300 men out of employment, has resumed in part.

The Shipman Engine Company, Rochester, N. Y., report their sales for November as exceeding by $2 500 those of the corresponding month of 1892.

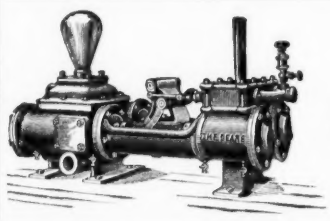
The Tyler Foundry and Machine Co. has been organized at Fort Worth, Tex., stock, $30,000 The incorporators are: A. L. Clark, J. F. Christian and John A. Bonner.

The Berlin Iron Bridge Co., East Berlin, Conn., issue a neat little pamphlet 3¼"x5¼", filled with testimonials as to the excellence of their work in shop and roof construction.

The Automatic Lasting Machine Co. has been organized at Saco, Me. The authorized capital stock is $100,000. The president is A J. Hoitt and the treasurer Charles Healey.

The unemployed workmen of the Lackawanna Iron and Steel Co., at Scranton, Pa., were informed recently that the south works, which ordinarily employed 1,500 men, will resume operations.

Jones & Laughlins have bought for $18,000 six three-story dwellings and ground near the foot of South Twenty-sixth street, Southside, Pittsburgh. The houses will be torn down and the ground used for an extension of the company's yard.



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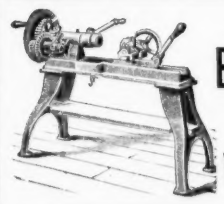

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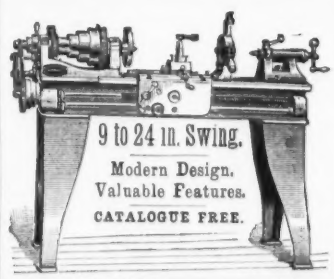

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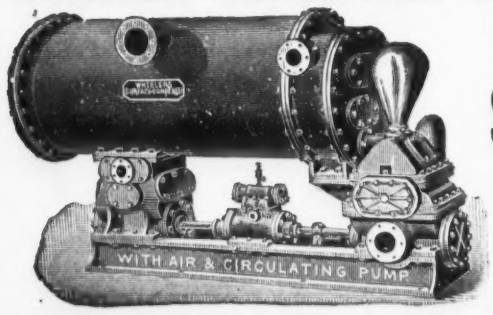

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In Media, Pa., the Trainer Mills, employing 100 hands, after four months' idleness, have started up on full time. The Campbell Mills are running night and day with two sets of hands on extra orders. The Simpson Works are also running overtime.

Wiley & Russell Mfg. Co., Greenfield, Mass., issue a new and very much enlarged catalogue of machinery and tools. They make a specialty of taps and dies, screw cutting, nut tapping and pipe cutting machinery, drilling machines, etc., which are illustrated and described in the catalogue.

The management of the Lookout Iron Co., Harriman, Tenn., are attempting to operate their works without a scale, but have not succeeded in securing any one to enter their service. The works have been idle a long time, but the men will not resume work without scale rates and organization.

The Belknap Motor Company, Portland, Me., have completed the purchase of the Giant Motor Company, including a large amount of fine machinery, stock on hand, right and patents. The inventory of stock amounts to $17,000. The purchase was made at a nominal figure.—*Industrial Journal.*

The trouble at the Norton Iron Works, Ashland, Ky., has been settled amicably between the men and the company. The scale will rule, and all the old hands are taken back. It is a matter of congratulation that this difficulty is satisfactorily ended. The works will be put in operation at once.

The Ironton Structural Steel Company, of Duluth, Minn., has started up its works. It is understood that the company has secured the contract for furnishing building plates, beams, etc., for a new building in that city, and that sufficient work will probably be secured from other sources to keep the new works busy during the winter.

The Northern Ohio Blanket Mills expect to resume operations about the first of the year, part of the old force of men in all the departments being put at work. The force of men at the mills, under normal conditions, consists of about 300 men. A member of the firm said recently that there were orders enough in to justify a partial resumption, and that more men might be put on before the winter is over.

P. Shellenback, of Richmond, Ind., whose improved engine lathe we described and illustrated in our issue of August 18, 1892, has moved his business to Liberty, Ind., and it has been combined with the business of the Liberty Manufacturing Co., an established concern that has been and still will be engaged in other lines of manufacture. The change gives Mr. Shellenback increased facilities and capital for carrying on the manufacture of his specialties in machine tools.

The Mason Regulator Co., of Boston, Mass., have made three additions to their popular engineering series. No. 4, "Electricity for Engineers," contains such facts about electrical machinery as every engineer who has it under his charge needs to know. Also all the rules of the Underwriters' Union, for the installation of electric plants, 50 cents, postpaid. No. 7, the "Engineers' Log Book," for keeping an accurate and systematic record of the engine room, 50 cents. No. 8, the "Chief Engineers' Record Book," for keeping a record of the mechanical plants of large factories, 75 cents. A sample page of the two last named books sent on receipt of stamp.

Machinists' Supplies and Iron.

NEW YORK, December 27, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.00 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $13.00 to $14.00 for No. 1 Foundry; $12.00 to $13.00 for No. 2, and $11.25 to $12.00 for Gray Forge.

Antimony—The market is quiet and steady. We quote L. X., 9.65c. to 9.70c.; Cookson's, 9.95c. to 10c.; Hallett's, 9c. to 9.05c., and U. S. French Star, 10c.

Lard Oil—Prime City is quoted at 70c. to 71c.

Copper—The market is dull, but prices remain steady. Lake Copper is quoted at 10.30c. to 10.35c. Casting Copper is held at 9.45c. to 9.75c.

Lead—The market is quiet, demand is light, and prices are firm at 3.30c. to 3.35c. for New York delivery.

Spelter—The market is dull, sellers are steady in their views, and prices are nominal at 3.60c. to 3.80c.

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13	2 1-4	1.35
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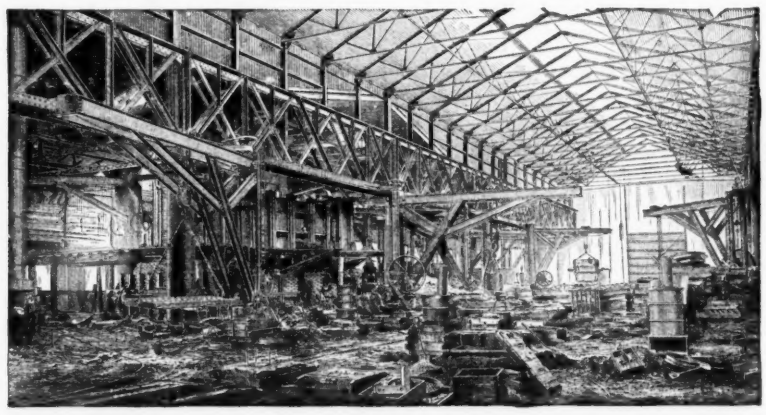

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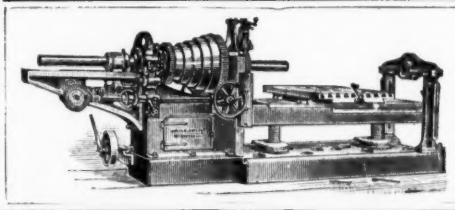

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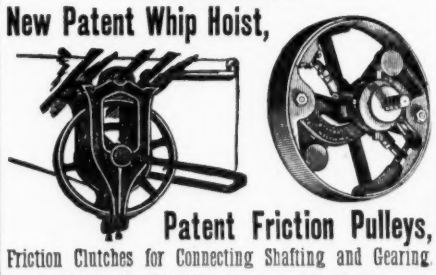

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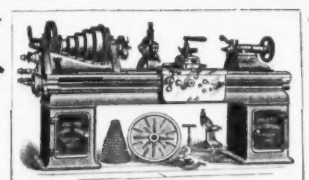
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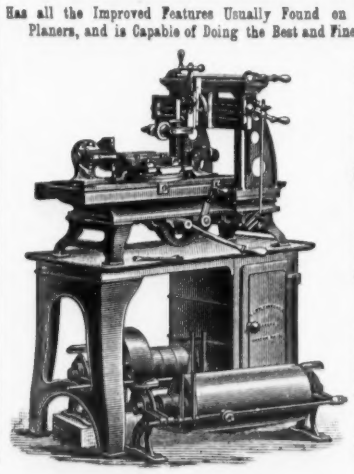

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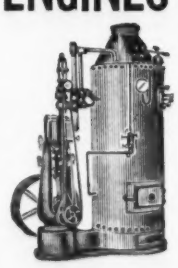

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Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

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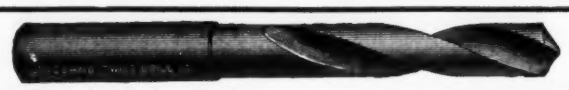

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Blaisdell Upright Drill, 40 in.
Improved Planer, 24 in. x 6 ft.
Hendey, 15 in. stroke Friction Shaper.
Crank Motion, 15 in. stroke Shaper.
Heavy, Improved 36 in. Gear Cutter.
Lincoln Milling Machine.
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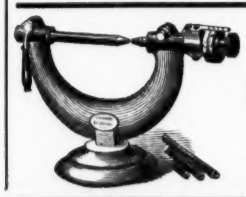

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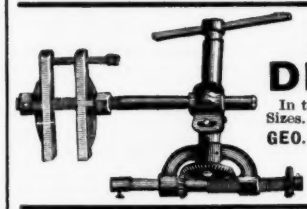

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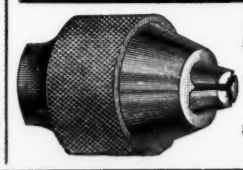

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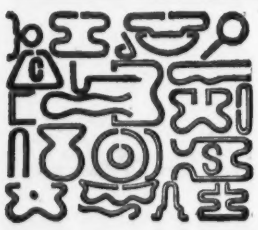

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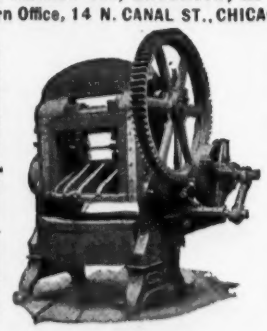

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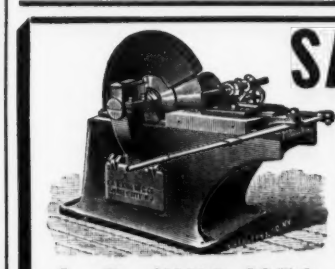

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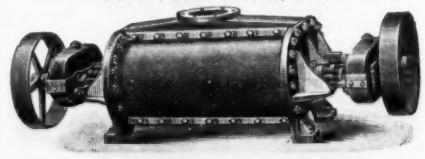

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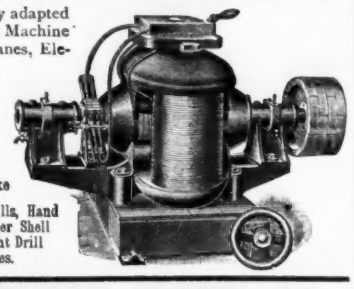

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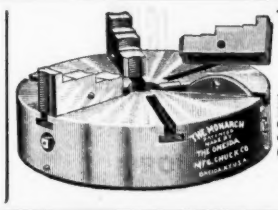

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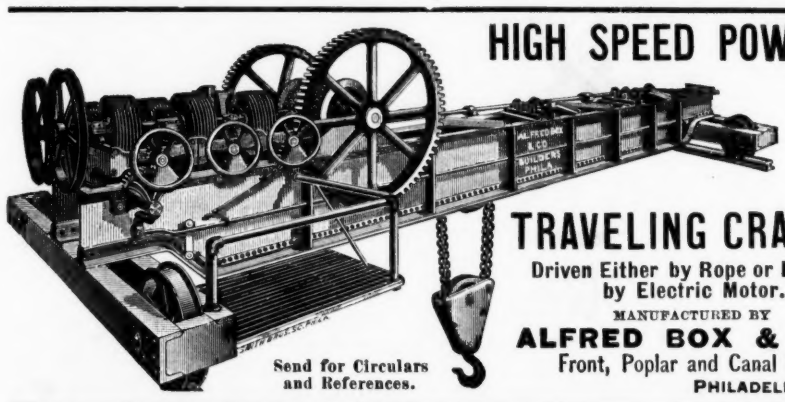

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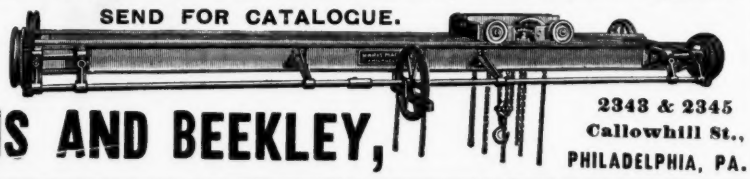

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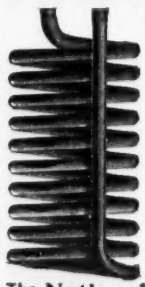

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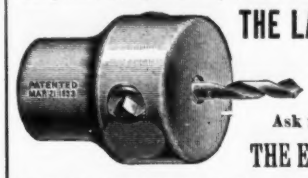

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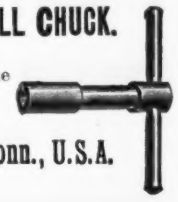

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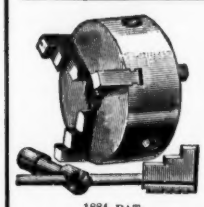

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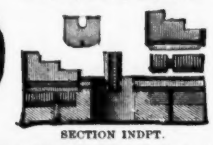

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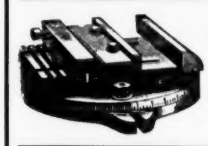

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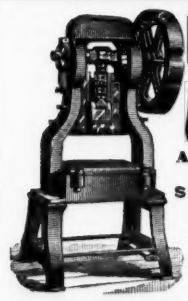

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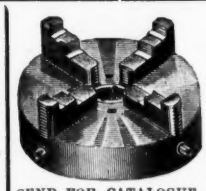

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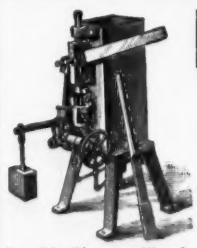

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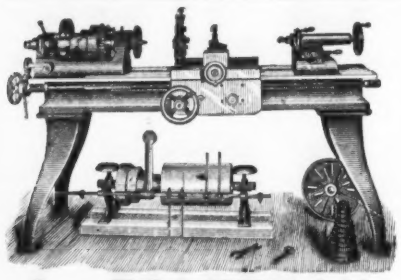

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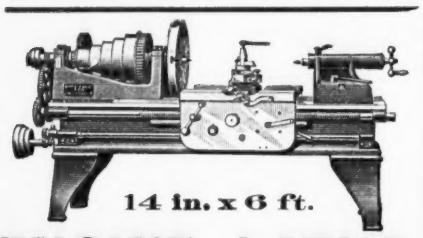

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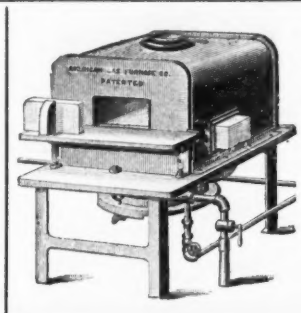

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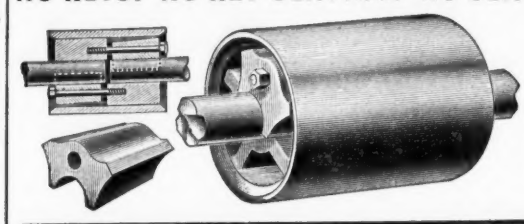

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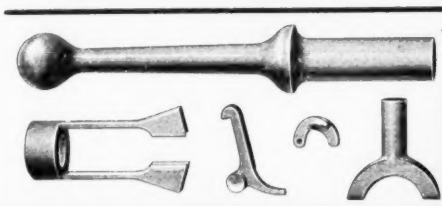

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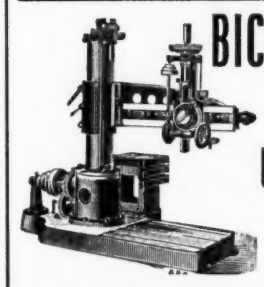

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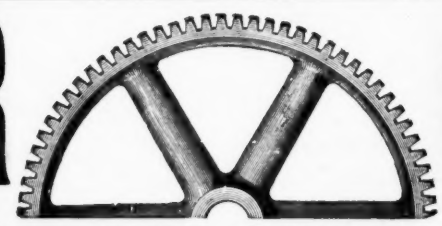

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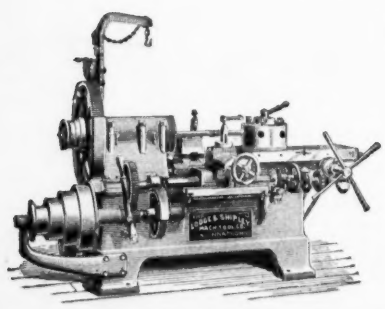

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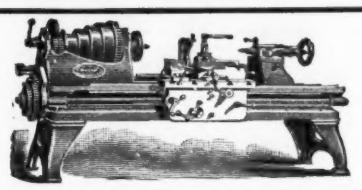

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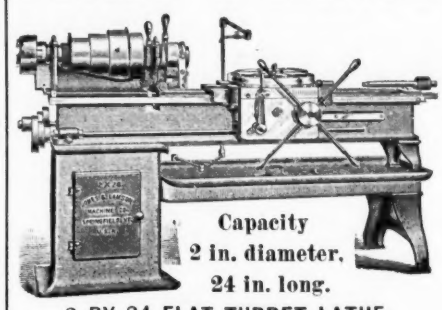

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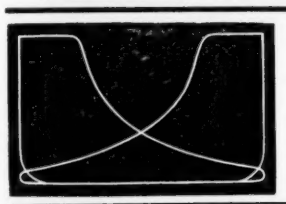

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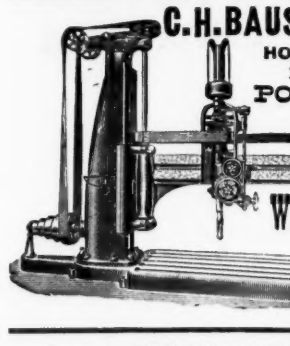

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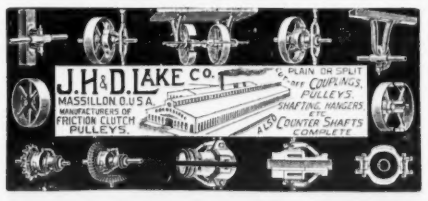
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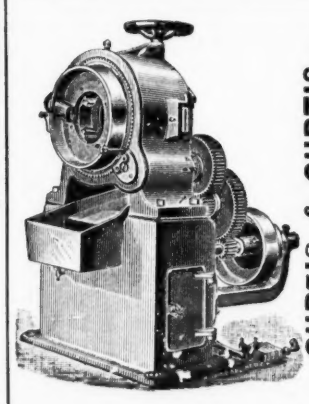

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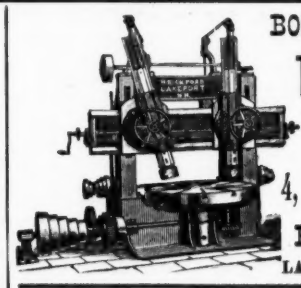

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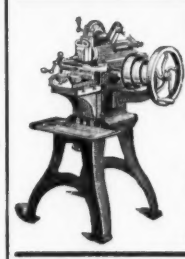

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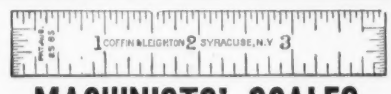

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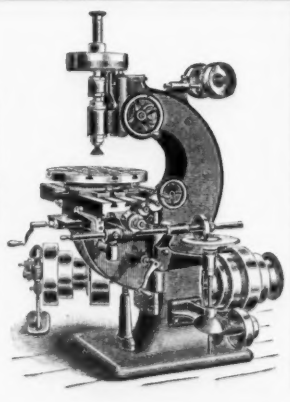

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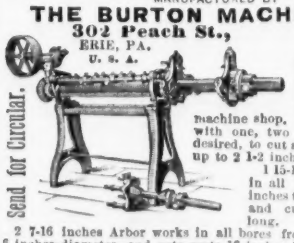

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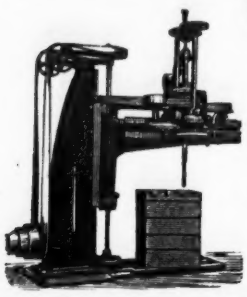

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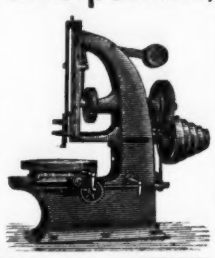

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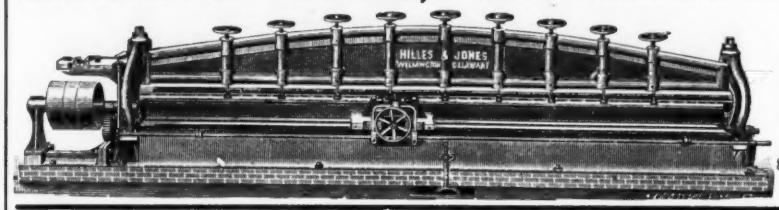

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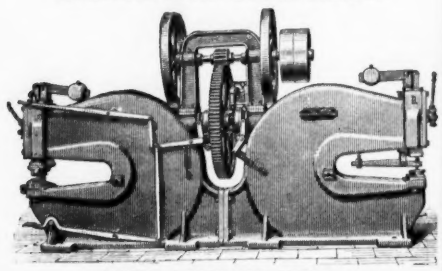

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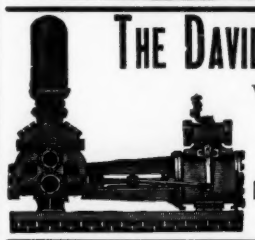

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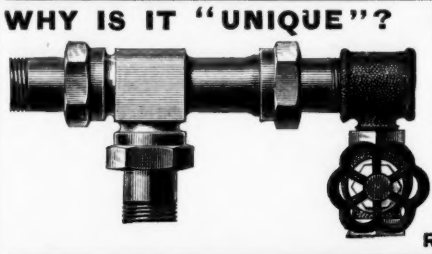

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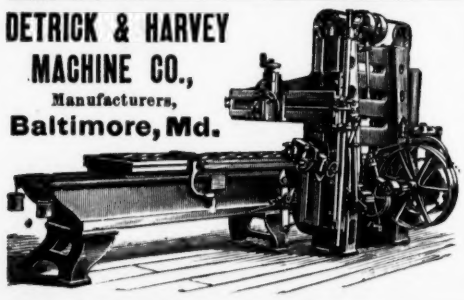

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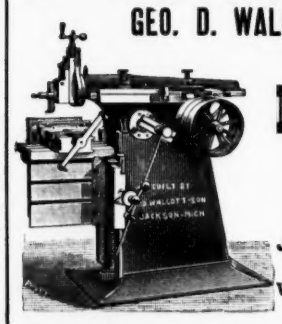

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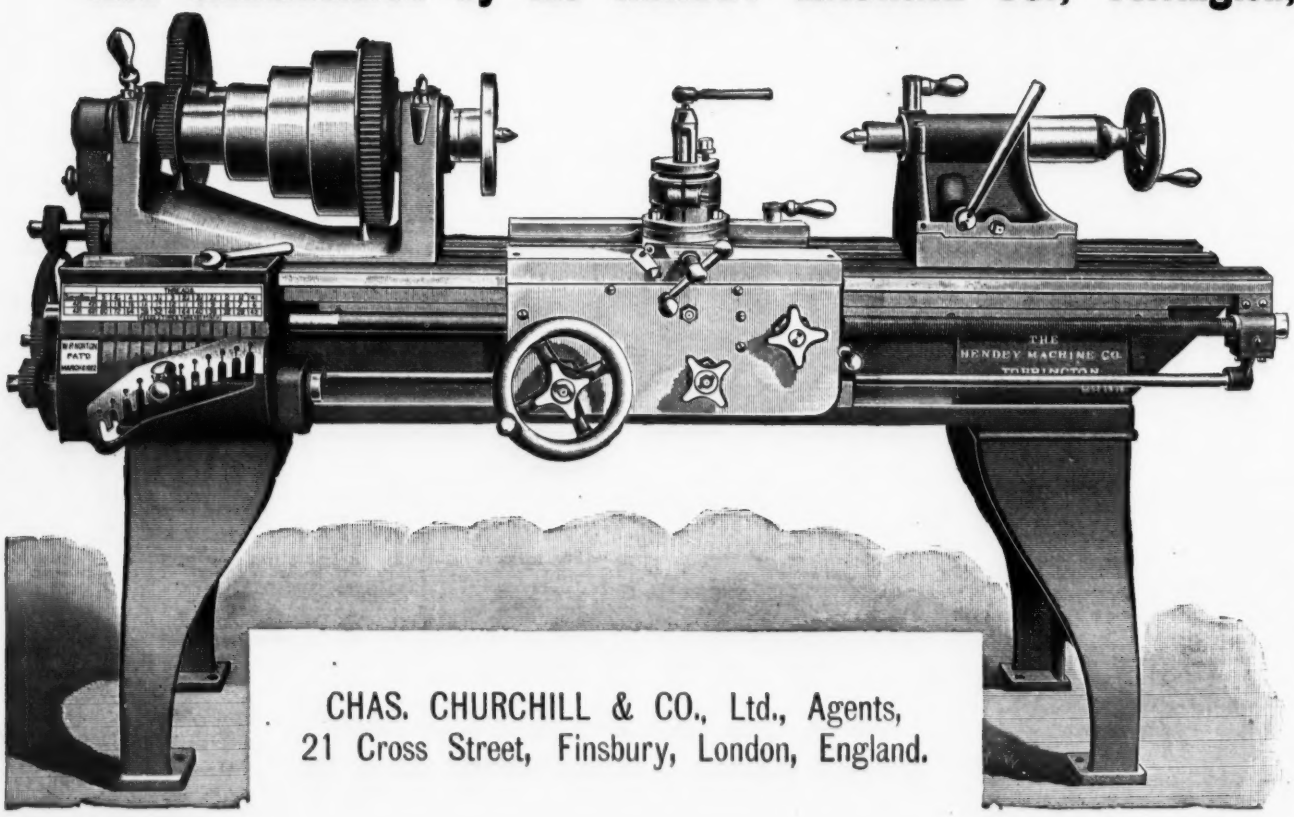

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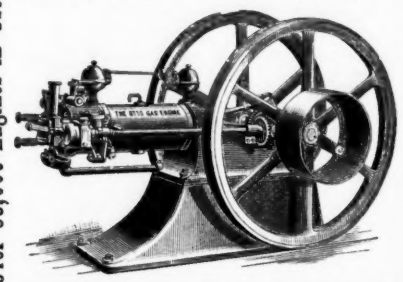

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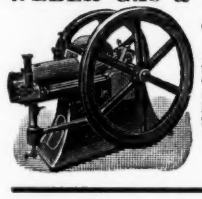

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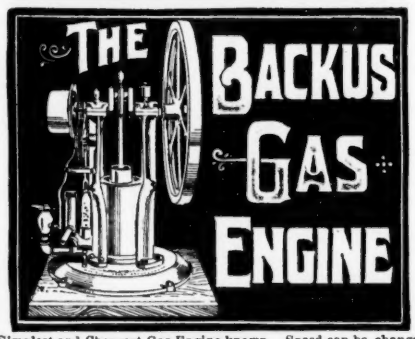

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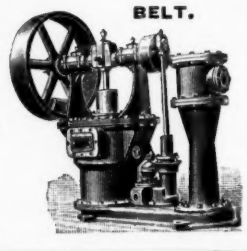

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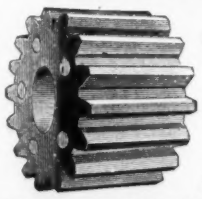

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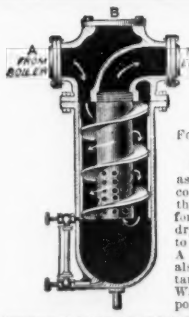

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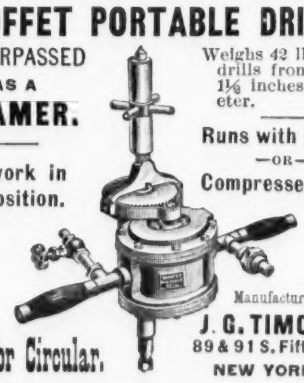

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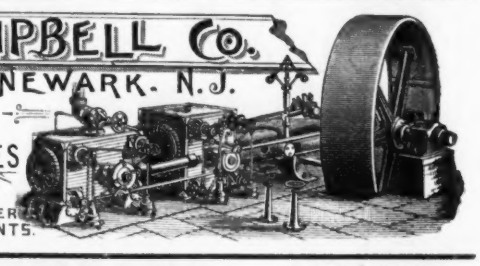

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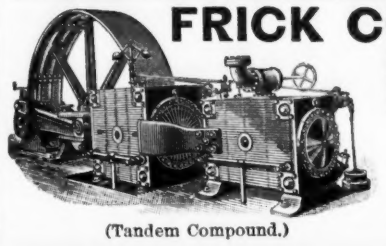

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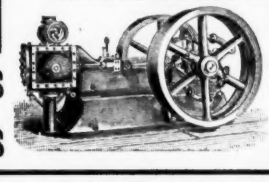

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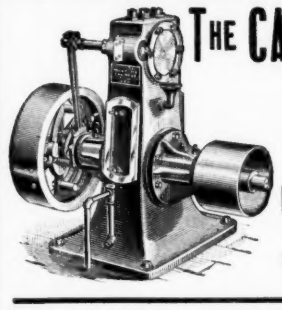

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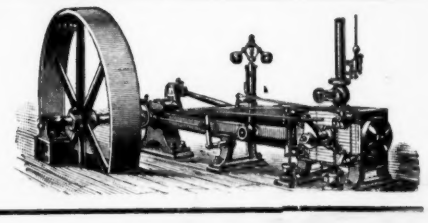

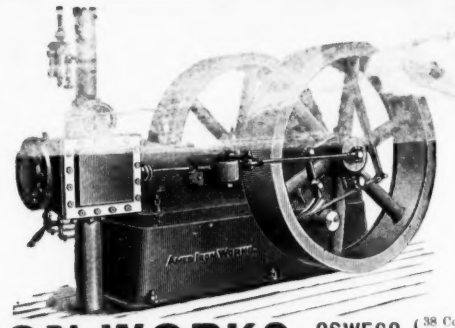

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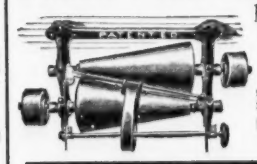

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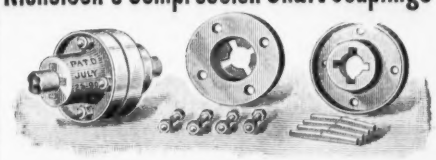

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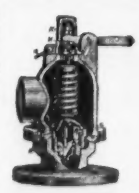

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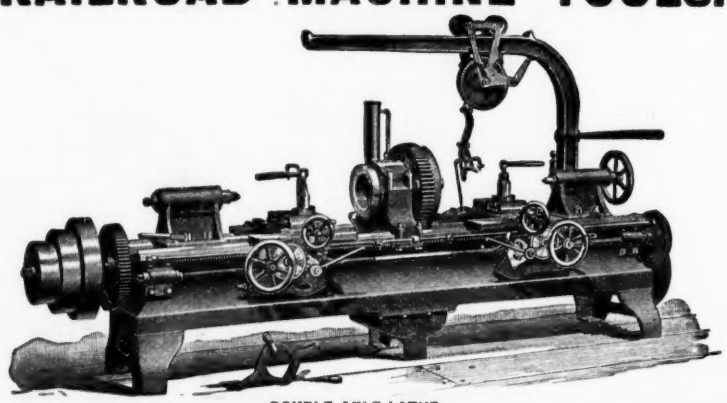

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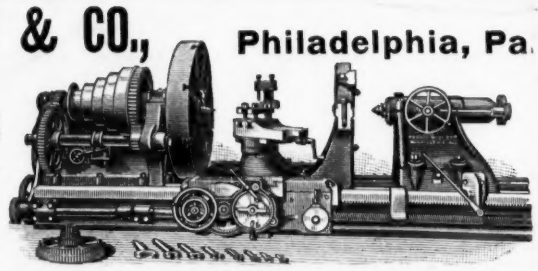

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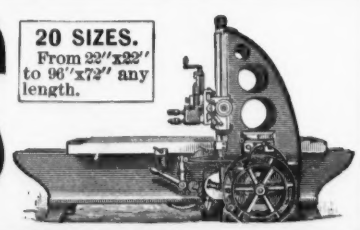

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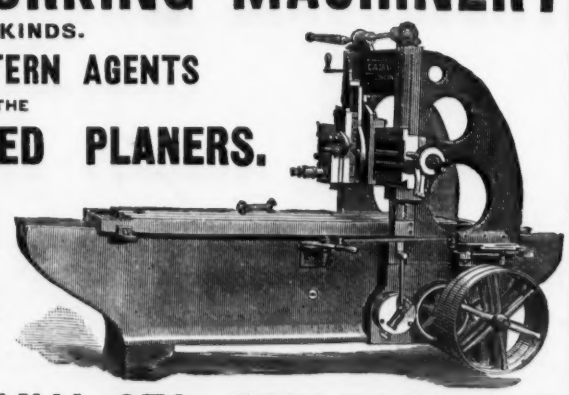

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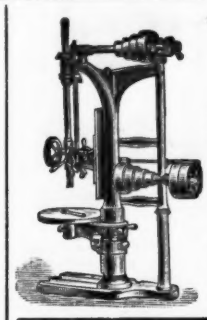

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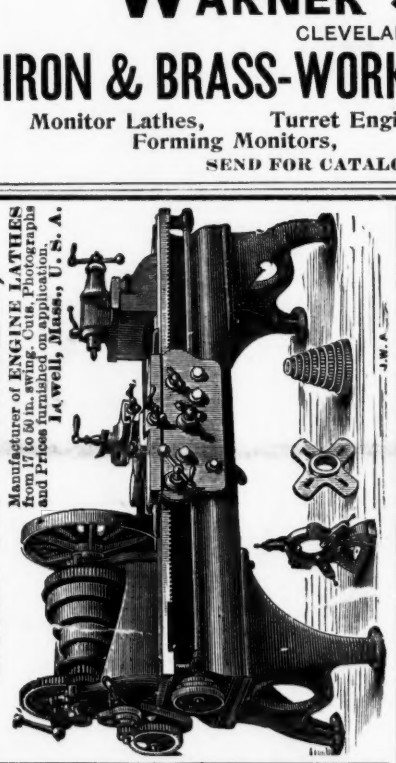

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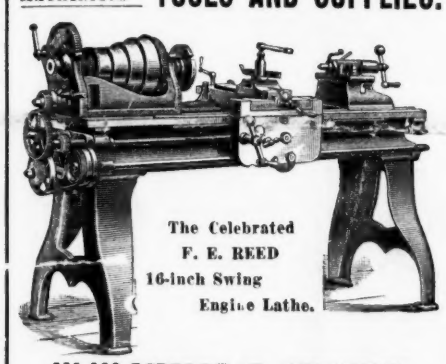

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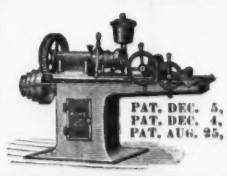

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